National Park Service
U.S. Department of the Interior
Aztec Ruins National Monument
Aztec, New Mexico

Vegetation Management and Cultural Landscape Preservation Maintenance Plan/

Environmental Assessment

December 2012




Clockwise: Former Cultivated Lands; the Great Kiva and West Ruins; Peering at the Unexcavated East Ruin; the Farmers Ditch

Vegetation Management and Cultural Landscape Preservation Maintenance Plan

Environmental Assessment

Summary

Aztec Ruins National Monument proposes to develop and implement a combined Vegetation Management and Cultural Landscape Preservation Maintenance Plan/Environmental Assessment to provide guidance and a decision-making framework on vegetation management and landscape preservation. This plan is needed because (1) numerous archeological resources at the Monument are covered by vegetation, some of which disturbs the subsurface cultural materials or deposits, (2) non-native invasive plants, including noxious weeds, have entered Aztec Ruins National Monument, causing damage to Monument resources, and (3) the current vegetation composition does not always contribute to or is not always compatible with the cultural landscapes at the Monument; therefore, cultural resource values are being diminished by non-contributing and incompatible plants.

This Plan/Environmental Assessment evaluates three alternatives: Alternative 1 – No Action, which is used as a baseline assessment; Alternative 2 - Proactive Vegetation/Cultural Landscape Management, which includes using a comprehensive toolbox of mechanical, chemical, and biological controls; and Alternative 3 – Limited Vegetation/Cultural Landscape Management, which includes a limited toolbox of mechanical and biological controls only.

This Plan/Environmental Assessment has been prepared in compliance with the National Environmental Policy Act (NEPA) and the National Historic Preservation Act (NHPA) to provide the decision-making framework that (1) analyzes a reasonable range of alternatives to meet project objectives, (2) evaluates potential issues and impacts to Aztec Ruins National Monument's resources and values, and (3) identifies mitigation measures to minimize the degree or extent of these impacts. Resource topics that have been addressed in this document because the resultant impacts may be greater-than-minor include vegetation, cultural landscapes, archeological resources, historic structures, visitor use and experience, wildlife, special status species, water resources, soil resources, and riparian/floodplains. All other resource topics have been dismissed because the project would result in negligible or minor effects to those resources. No major effects are anticipated as a result of this project. Public scoping was conducted to assist with the development of this document; three comments were received, mostly in favor of the proposal.

Public Comment

This Plan/Environmental Assessment will be on public review for 30 days ending November 20, 2012. If you wish to comment on this document, you may enter your comments online at the National Park Service website Planning, Environment, and Public Comment (See web links section in references). You may also mail or hand deliver comments to the Superintendent at Aztec Ruins National Monument, #84 County Road 2900, Aztec, NM 87410. Our practice is to make comments, including names and home addresses of respondents, available for public review during regular business hours. Individual respondents may request that we withhold their home address from the record, which we would honor to the extent allowable by law. There also may be circumstances in which we would withhold from the record a respondent's identity, as allowable by law. If you wish us to withhold your name and/or address, you must state this prominently at the beginning of your comment. We would make all submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, available for public inspection in their entirety.

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Introduction

Authorized as a unit of the National Park Service in 1923, Aztec Ruins National Monument is an archeological site in northwestern New Mexico (Fig. 1). The Monument covers approximately 318 acres and is almost entirely surrounded by the City of Aztec, New Mexico. Aztec Ruins contains some of the most remarkably well-preserved ancestral Pueblo architecture in the Southwest. It is monumental in scale, both in its designed landscape, as well as in its individual structures. This planned community is characterized by its symmetrical layout, its unique complex of architectural features that includes rare tri-walled structures, and its unusually well preserved masonry and wood structures, artifacts, earthworks, and other remains from approximately A.D. 1050 to 1300. Original wooden roofs still cover dozens of rooms and have enabled Aztec Ruins to become the best tree-ring-dated site in the Southwest. The high integrity and importance of the site were additionally recognized in 1987 when Aztec Ruins National Monument, along with Chaco Culture National Historical Park, were together designated a World Heritage Site.

Aztec Ruins is an integral component of 200 to 300 years of cultural cohesiveness and expression that occurred throughout the Four Corners region from approximately A.D. 1050 to 1300. The site is an important aid to understanding earlier times of the Pueblo world. Furthermore, pioneering excavations of the American Museum of Natural History (AMNH) provided archeological data and explanations that influenced interpretations of cultural history in the San Juan Basin for nearly a century as well as the profession as a whole. Reconstruction of the Great Kiva was an unparalleled effort in the history of southwestern archeology.

Aztec Ruins was established on January 24, 1923 on a little more than 4 acres when President Warren G. Harding signed the following proclamation. "Whereas, there is near the town of Aztec, New Mexico, a ruin of great antiquity and historical interest; and, Whereas, the ground on which said ruin stands has been donated to the United States for the establishment of a national monument with a view to the preservation of said ruin for the enlightenment and culture of the nation" (January 24, 1923, 42 Stat. 2295, appended). Executive Orders 1840 (July 1, 1928, 45 Stat. 2954) and 1928 (December 19, 1930, 46 Stat. 3040) added an additional 14.4 acres to the Monument, including East Ruin, the museum's field headquarters, and in the southwest corner of the Monument the home of Earl Morris, the archeologist who led the AMNH excavation of Aztec Ruins. Executive Order 1928 included an additional 6.87 acres purchased from the heirs of H. D. Abrams, the original owner of the site. A donation in 1948 from the Southwestern Monuments Association (Presidential Proclamation Number 2787, May 27, 1948, 65 Stat. 1513) brought the Monument to 27.14 acres. Public Law 100-559 (October 28, 1988, title IV) authorized an expanded Monument boundary of nearly 320 acres.

The purpose of Aztec Ruins National Monument is to preserve, protect, and interpret the ancient Pueblo structures and to encourage and conduct scientific research that would enhance understanding of prehistoric and historic stories related to the site.

The General Management Plan for Aztec Ruins National Monument (NPS 2011) recommends development of a combined Vegetation Management and Cultural Landscape Preservation Maintenance Plan to provide guidance and a decision-making framework on vegetation management and landscape preservation. The Monument currently does not have such a plan; without such a plan or overall direction, the Monument has struggled with an inefficient use of resources, including piecemeal compliance for meeting statutory requirements. Therefore, the overall goal or purpose of this process is to develop a combined Vegetation Management and Cultural Landscape Preservation Maintenance Plan that provides desired future conditions and how to achieve those conditions, in accordance with the direction provided in the General Management Plan. The vegetation and cultural landscape management plans are being combined because vegetation plays an integral role in shaping, maintaining and preserving a cultural landscape. In order to fulfill preservation of a desired cultural landscape the impacts

of vegetation management to a cultural landscape must be considered at Aztec Ruins National Monument because it is currently not consistent throughout the park. This is due to approaches to vegetation management that have not been aligned with the cultural landscape in the recent past.

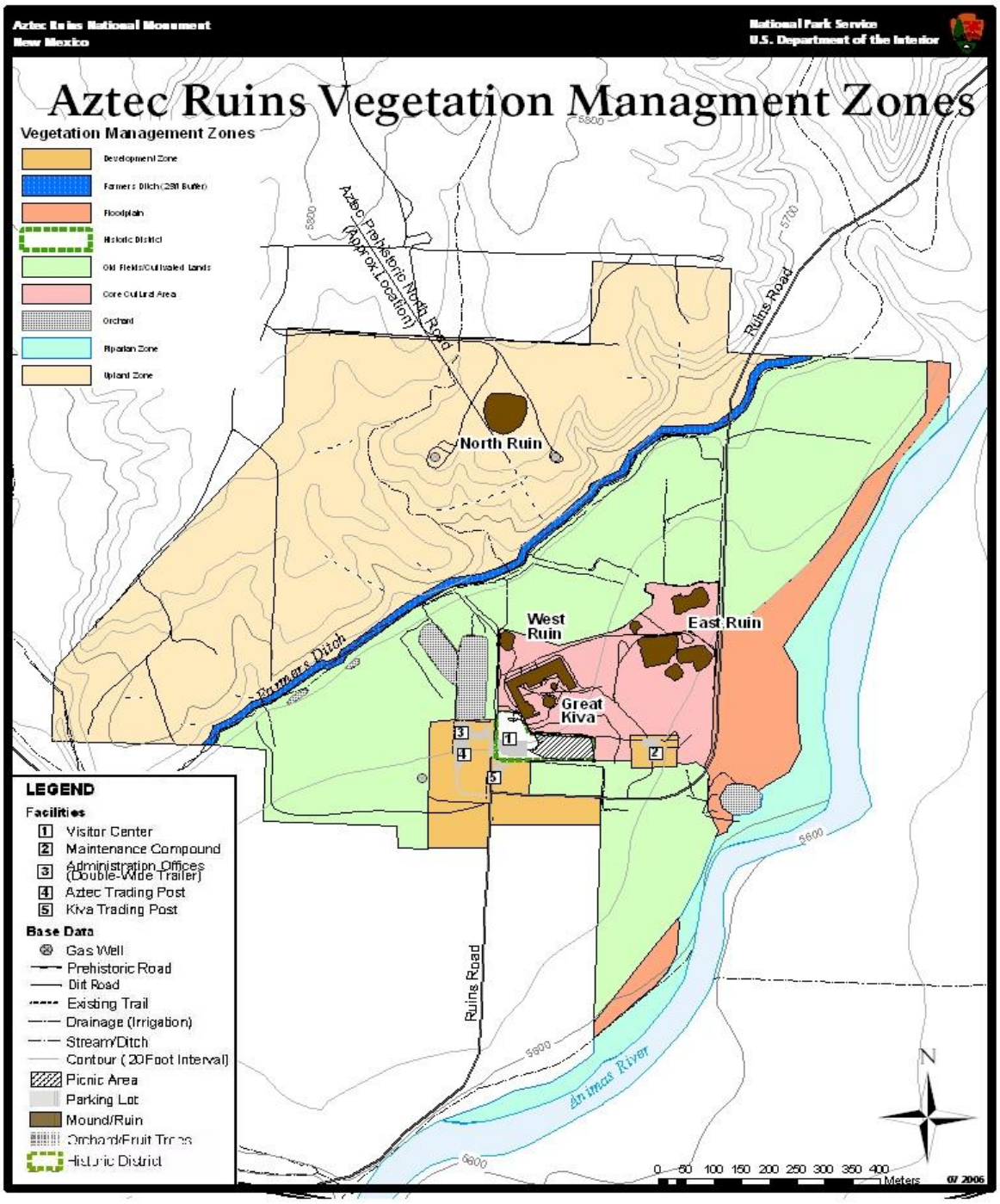

Figure 1 – Vegetation Management Zones for Aztec Ruins National Monument, New Mexico.

The purpose of the Environmental Assessment is to examine the environmental impacts associated with implementing a Vegetation Management and Cultural Landscape Preservation Maintenance Plan at Aztec Ruins National Monument. This Environmental Assessment has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, the National Historic Preservation Act (NHPA), regulations of the Council on Environmental Quality (CEQ) (40 CFR 1508.9), and the National Park Service Director's Order (DO)-12 (*Conservation Planning, Environmental Impact Analysis, and Decision-making*).

Purpose and Need

Aztec Ruins National Monument was established to preserve its prehistoric cultural resources, many of which are archeological in nature. A number of archeological resources at the Monument are covered by vegetation, some of which disturbs the subsurface cultural materials or deposits. The root structure of certain types of vegetation is particularly damaging to subsurface cultural materials because the roots grow, move, and create pathways for water and fire. All of these actions can adversely impact intact deposits, thereby altering the archeological record and information we can gain from this record.

Areas without vegetation can similarly be damaging in that without vegetation, there is a greater occurrence of erosion. Erosion can adversely impact buried remains because it eats away at the stratigraphy of archeological sites, exposes previously undisturbed materials to the elements, and contributes to deterioration of ruins. Areas without vegetation can also lead to presence of invasive species, some of which can harm deposits. Therefore, the proposed action is needed to minimize past and future damage and prevent impairment to cultural resources from lack of appropriate vegetation or from vegetation that is inappropriate for the site.

Non-native invasive plants, including noxious weeds, have become established at Aztec Ruins National Monument, causing damage to Monument resources. Invasive species threaten cultural resources and compromise the structure, organization, function, and integrity of natural ecosystems. In 2001, 105 plant species, including 19 non-native species, were documented. More recently, almost 300 plant species have been documented in the Monument (Rink and Cully 2007). Since the 2001 inventory, invasive species populations within the Monument have been growing and spreading to new areas, often displacing native plant communities.

Results from a non-native weed inventory conducted in 2008 indicate occurrence of at least 57 species of non-native plants within the Monument boundaries (Korb 2008). The riparian areas and old fields are of particular concern with spreading invasive plants. Ditches are also a concern as a source of spreading invasive plants. Controlling invasive species is a serious challenge facing the Monument. The proposed action is needed to prioritize, control, and/or eradicate non-native species where feasible and to monitor the efficacy of management actions. This action is also needed to prevent the spread of existing non-native species and introduction of new non-native species.

The Monument contains two significant cultural landscapes that are eligible for the National Register of Historic Places: the Ancient Aztec Community prehistoric designed community (henceforth, referred to as the Ancient Aztec Landscape) and Aztec Ruins Historic District Landscape historic designed landscape (from here, referred to as Aztec Ruins Historic District Landscape). Some of the existing vegetation does not contribute to or is incompatible with these cultural landscapes. Cultural resource values and visitor experience are diminished by these non-contributing and incompatible plants. The Historic Landscape has lost some integrity due to incongruent vegetation types. The proposed plan is needed to improve the condition and to restore integrity of the Ancient Aztec Community and Aztec Ruins Historic District where possible through vegetation management.

One objective of the proposed plan is to involve Monument neighbors and the public in order to enhance understanding and support for a sustainable vegetation management program. It is important for a more complete and meaningful visitor experience to portray plant communities that are congruent with the historic cultural landscapes. Maintaining and/or restoring natural plant communities provides for a better

ecological and visitor experience to best interpret the resources available to the Ancient Aztec Community. Restoration of the plant communities would eventually result in a natural wildlife community, which would also more accurately represent wildlife resources that existed with the Ancient Aztec Community. Current vegetation conditions at Aztec Ruins NM have undergone numerous alterations throughout more modern historic times, resulting in vegetation communities that fail to represent prehistoric resource conditions.

Humans have impacted and continue to impact natural ecosystems and processes that maintain them. For example, the Farmers Ditch contributes to continual spread of non-native vegetation, and past livestock grazing has disrupted natural grazing by native wildlife species. The Monument is almost completely surrounded by human activities, including housing developments, agricultural fields, and the city of Aztec. The Vernacular Landscape, which includes a historic homestead area within the Monument, has provided habitat for prairie dogs that disturb archeological resources. Monument and visitor activities, such as trails, contribute to the spread of invasive plants.

Some existing vegetation poses health and safety issues. Hazard trees in public areas are of particular concern. For example, many mature cottonwoods (*Populus* spp.) can be infested with fungal infections, resulting in decomposition from within, increasing risks of large branches breaking or entire trees falling spontaneously. With hazard trees present in public areas, liability issues increase. Other health and safety issues include the possibility of venomous snakes resting under overgrown brush in public areas near trails and common-use areas. Therefore, an objective of this project is to improve health and safety and reduce liability issues through vegetation management.

Cultural landscapes overlie one another and create some conflicting vegetation and management needs. Current vegetation does not promote the desired interpretive themes. For example, the native vegetation that contributes to the Ancient Aztec Community Landscape does not contribute to the Vernacular Landscape. Conversely, features of the Vernacular Landscape, such as the corral and outbuildings, are incompatible with the Ancient Aztec Community Landscape. Some features, such as ditches, in Vernacular Landscapes may be eligible for the National Register but do not contribute to the Ancient Aztec Community Landscape. Contemporary visual intrusions (e.g., overhead power lines, gas wells, and interpretive trails) do not contribute to any of the three landscapes Therefore, this action is needed to (1) define priorities for cultural landscape treatments, and (2) improve the condition and integrity of the Ancient Aztec Community and Aztec Ruins Historic District Landscape where possible.

Friends, partners, agencies, tribes, and stakeholders of Aztec Ruins National Monument have expressed interest with regards to vegetation and cultural landscape management. Some tribes have expressed interest in maintaining and perhaps expanding traditional connections; however, little is known about tribal connections to ethnobotanical resources. Local plant societies have offered assistance with non-native weed management. Other partnership opportunities also exist; therefore, this project is needed to pursue partnership opportunities, as feasible, to improve vegetation management within the Monument and across administrative boundaries.

Based on the purpose and need of the project, objectives for the proposal plan are to (1) minimize past and future damage and prevent impairment to cultural resources from vegetation or lack thereof, (2) prevent the spread of non-native and/or invasive species and introduction of new non-native species, (3) improve the condition and integrity of the Ancient Aztec Community and Aztec Ruins Historic District Landscape, where possible, through vegetation management, (4) educate and involve Monument neighbors and the public to enhance understanding and support for a sustainable vegetation management program, (5) protect, restore, rehabilitate, and revegetate to a self-sustaining native regime that is compatible with the Ancient Aztec Community Landscape, (6) restore, rehabilitate, and revegetate agriculturally-disturbed areas to a self-sustaining native regime, (7) protect and enhance, when feasible and appropriate, areas within Aztec Ruins that are dominated by native species from additional impacts, (8) improve health and safety and reduce liability issues through vegetation management, (9) define priorities for cultural landscape treatments, and (10) pursue partnership opportunities as feasible to improve vegetation management within the Monument and across administrative boundaries.

Relationship of the Proposed Action to Previous Planning Efforts

Aztec Ruins National Monument was established to preserve its prehistoric cultural resources. Non-native invasive plants, including noxious weeds, in Aztec Ruins National Monument are causing damage to Monument resources. Invasive plant species threaten cultural resources and the structure, organization, function, and integrity of natural ecosystems. The Vegetation Management and Cultural Landscape Preservation Maintenance Plan provides guidance and a decision making framework for vegetation management and landscape preservation and is consistent with the mission of Aztec Ruins National Monument and the National Park Service *2006 Management Policies.*

The 2010 *General Management Plan* is a comprehensive management plan that encompasses preservation of natural and cultural resources --- especially extensive archeology, visitor use and interpretation, and facilities development, with the input of stakeholders and up to 26 southwestern American Indian tribes, who consider the Monument a sacred ancestral site.

The GMP sets out four significance statements, "…to identify primary Monument interpretive themes and desirable visitor experiences, and would help Monument managers establish management priorities" (USDI 2006). Three of the statements relate to the Ancient Aztec Landscape: (1) ancestral Puebloan use and interactions with the landscape, (2) the story of Aztec Ruin's place within the larger ancestral Puebloan cultural area in the eleventh to thirteenth centuries, and (3) the remarkably well preserved structures and related artifacts found within the monument. The fourth statement identified significance focuses on the pioneering excavations by the American Natural History Museum. Historic farming history and related remnants on the landscape are not identified as being of high priority in the GMP (USDI 2006). Retention of the orchards and other non-native vegetation may help visitors learn about recent historic farming in the area, but this history is not identified as a high priority or desirable visitor experience.

The Vegetation Management and Cultural Landscape Preservation Maintenance Plan follows the guidance set forth in the GMP regarding vegetation management and landscape preservation by removing non-native vegetation and re-introducing native vegetation which is stated in the GMP as a contributing element of the Prehistoric Designed Landscape.

The proposal is consistent with the goals of the 2005 *Aztec Ruins National Monument Fire Management Plan* (USDI 2005), which calls for developing strategies that would help protect the Monument from impacts of fire and fire suppression. Additionally, the proposal is consistent with the overall goals of the *Cultural Landscape Inventory* (NPS 2005b) and *Road Abandonment Environmental Assessment* (USDI 2002).

Impact Topics Retained for Further Analysis

Impact topics for this project have been identified on the basis of federal laws, regulations, and orders as well as the National Park Service *2006 Management Policies* (NPS 2006) and National Park Service knowledge of resources at Aztec Ruins National Monument. Impact topics that are carried forward for further analysis in this Plan/Environmental Assessment are (1) vegetation, (2) cultural resources, including cultural landscape, historic structures, and archeological resources, (3) visitor use and experience, (4) wildlife, (5) special status species, (6) water resources, (7) soil resources, and (8) riparian and floodplains. These impact topics are listed below along with the reasons why the impact topic is further analyzed.

Vegetation

According to the National Park Service's *2006 Management Policies*, the National Park Service strives to maintain all components and processes of naturally evolving park unit ecosystems, including the natural abundance, diversity, and ecological integrity of plants (NPS 2006). This impact topic has been retained because there are greater than minor impacts from non-native plant removal using mechanical, biological, cultural, chemical, and prescribed fire tools and greater than minor impacts due to actions to preserve and restore native plant species and the cultural landscape.

Cultural Resources

Cultural Landscapes

According to the National Park Service's Director's Order 28 *Cultural Resource Management Guideline*, a cultural landscape is a reflection of human adaptation and use of natural resources; it is often expressed in the way land is organized and divided, patterns of settlement, land use, systems of circulation, and the types of structures that are built. The character of a cultural landscape is defined both by physical materials, such as roads, buildings, walls, and vegetation, and by use reflecting cultural values and traditions.

Cultural landscapes result from the long interaction between humans and the land. Shaped through time by land-use practices as well as levels of technology, and economic conditions, cultural landscapes provide a living record of an area's past. The dynamic nature of modern human life, however, contributes to the continual reshaping of cultural landscapes, making them a good source of information about specific times and places, but at the same time rendering their long-term preservation a challenge.

Historic Structures

Section 106 of the National Historic Preservation Act, as amended in 1992 (16 USC 470 *et seq.*), the National Park Service's Director's Order 28 *Cultural Resource Management Guideline*, and National Park Service *2006 Management Policies* (NPS 2006) require consideration of impacts on historic properties that are listed or eligible to be listed in the National Register of Historic Places. The National Register is the nation's inventory of historic places and the national repository of documentation on property types and their significance. The above-mentioned policies and regulations require federal agencies to coordinate consultation with State Historic Preservation Officers regarding potential effects to properties listed on or eligible for the National Register of Historic Places.

The National Park Service, as steward of many of America's most important cultural resources, is charged to preserve historic properties for the enjoyment of present and future generations. Management decisions and activities throughout the National Park Service must reflect awareness of the irreplaceable nature of these resources. The National Park Service would protect and manage cultural resources in its custody through effective research, planning, and stewardship and in accordance with the policies and principles contained in the *2006 Management Policies* and the appropriate Director's Orders. This impact topic has been retained because there are greater than minor impacts from non-native plant removal either on or near historic structures using mechanical, biological, cultural, chemical, and prescribed fire tools and greater than minor impacts due to actions to preserve and restore native plant species and the cultural landscape.

"Historic Structures" also include ancient architectural sites that are older than the "prehistoric" period. In this document, ancestral Pueblo buildings and ruins are included with "archeological resources," and the topic of "historic structures" is confined to those which are "historic" in age, that is, dating after the time of Euro-American occupation.

Archeological Resources

In addition to the National Historic Preservation Act and the National Park Service *2006 Management Policies* (NPS 2006), the National Park Service's Director's Order, 28B *Archeology*, affirms a long-term

commitment to the appropriate investigation, documentation, preservation, interpretation, and protection of archeological resources inside units of the National Park System. As one of the principal stewards of America's heritage, the National Park Service is charged with preservation of the commemorative, educational, scientific, and traditional cultural values of archeological resources for the benefit and enjoyment of present and future generations.

Archeological resources are nonrenewable and irreplaceable, so it is important that all management decisions and activities throughout the National Park Service reflect a commitment to the conservation of archeological resources as elements of our national heritage. This impact topic has been retained because there are greater than minor impacts from non-native plant removal either on or near archeological resources using mechanical, biological, cultural, chemical, and prescribed fire tools and greater than minor impacts due to actions to preserve and restore native plant species and the cultural landscape.

Visitor Use and Experience

According to *2006 Management Policies*, the enjoyment of Monument resources and values by people is part of the fundamental purpose of all park units (NPS 2006). The National Park Service is committed to providing appropriate, high quality opportunities for visitors to enjoy the parks and would maintain within the parks an atmosphere that is open, inviting, and accessible to every segment of society. Further, the National Park Service would provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in the parks. The National Park Service *2006 Management Policies* also state that scenic views and visual resources are considered highly valued associated characteristics that the National Park Service should strive to protect (NPS 2006). This impact topic has been retained because visitor use would experience greater than minor impacts from non-native plant removal either using mechanical, biological, cultural, chemical, and prescribed fire tools and greater than minor impacts due to actions to preserve and restore native plant species and the cultural landscape because visitors may see, hear, or smell the treatments.

Aztec Ruins National Monument is open year round except Thanksgiving, Christmas, and New Year's days. The monument averages about 58,000 visitors per year, and peak visitation occurs from mid-May through September. Because of the monument's small size, easy access, convenient location, and availability of nearby overnight accommodations, the facilities at the monument are for day use only. The principal visitor activities are touring the Visitor Center/Museum, viewing an orientation film, taking the self-guided tour of the excavated West Ruin, and picnicking. The average length of stay is less than two hours (USDI 2001).

Wildlife

According to the National Park Service's *2006 Management Policies*, the National Park Service strives to maintain all components and processes of naturally evolving park unit ecosystems, including the natural abundance, diversity, and ecological integrity of animals (NPS 2006). This impact topic has been retained because there are greater than minor impacts to wildlife through habitat manipulation, removal of non-native plants using mechanical, biological, cultural, chemical, and prescribed fire tools and greater than minor impacts due to actions to preserve and restore native plant species and the cultural landscape.

Special Status Species

The Endangered Species Act of 1973 requires examination of impacts on all federally listed threatened, endangered, and candidate species. Section 7 of the Endangered Species Act requires all federal agencies to consult with the U.S. Fish and Wildlife Service (or designated representative) to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence

of listed species or critical habitats. In addition, the *2006 Management Policies* and Director's Order 77 *Natural Resources Management Guidelines* require the National Park Service to examine the impacts on federal candidate species, as well as state-listed threatened, endangered, candidate, rare, declining, and sensitive wildlife and vegetation species (NPS 2006). This impact topic has been retained because there are greater than minor impacts to species with special status through habitat manipulation, removal of non-native plants using mechanical, biological, cultural, chemical, and prescribed fire tools and greater than minor impacts due to actions to preserve and restore native plant species and the cultural landscape.

Water Resources

National Park Service policies require protection of water quality consistent with the Clean Water Act. The purpose of the Clean Water Act is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." To enact this goal, the U. S. Army Corps of Engineers has been charged with evaluating federal actions that result in potential degradation of waters of the United States and issuing permits for actions consistent with the Clean Water Act. The U. S. Environmental Protection Agency also has responsibility for oversight and review of permits and actions, which affect waters of the United States. This impact topic has been retained because there are greater than minor impacts to water resources through removal of non-native plants using mechanical, biological, cultural, chemical, and prescribed fire tools and greater than minor impacts due to actions to preserve and restore native plant species and the cultural landscape.

Soils

According to the National Park Service's *2006 Management Policies*, the National Park Service "would actively seek to understand and preserve the soil resources of parks, and to prevent, to the extent possible, the unnatural erosion, physical removal, or contamination of the soil or its contamination of other resources. Parks would obtain adequate soil surveys for the management of park resources. All soil surveys would follow National Cooperative Soil Survey Standards. Products would include soil maps, determinations of the physical and chemical characteristics of soils, and the interpretations needed to guide resource management and development decisions."

Riparian Zone/Floodplain

Executive Order 11988 *Floodplain Management* requires all federal agencies to avoid construction within the 100-year floodplain unless no other practicable alternative exists. The National Park Service under *2006 Management Policies* and Director's Order 77-2 *Floodplain Management* would strive to preserve floodplain values and minimize hazardous floodplain conditions. According to Director's Order 77-2 *Floodplain Management*, certain construction within a 100-year floodplain requires preparation of a statement of findings for floodplains. This impact topic has been retained because there are greater than minor impacts from non-native plant removal in the riparian zone/floodplain using mechanical, biological, cultural, chemical, and prescribed fire tools and greater than minor impacts due to actions to preserve and restore native plant species in the riparian zone.

Impact Topics Dismissed From Further Analysis

Some impact topics have been dismissed from further consideration, as listed below. The rationale for dismissing these specific topics is stated for each resource.

Air Quality

The Clean Air Act of 1963 (42 U.S.C. 7401 *et seq.*) was established to promote public health and welfare by protecting and enhancing the nation's air quality. The act establishes specific programs that provide special protection for air resources and air quality related values associated with National Park Service units. Section 118 of the Clean Air Act requires a park unit to meet all federal, state, and local air pollution standards. Aztec Ruins National Monument is designated as a Class II air quality area under the Clean Air Act. A Class II designation indicates the maximum allowable increase in concentrations of pollutants over baseline concentrations of sulfur dioxide and particulate matter as specified in Section 163 of the Clean Air Act. Further, the Clean Air Act provides that the federal land manager has an affirmative responsibility to protect air quality related values (including visibility, plants, animals, soils, water quality, cultural resources, and visitor health) from adverse pollution impacts.

The use of chemical herbicides has the potential for negligible to minor short-term effect to air quality due to volitization of some herbicides during hot air temperatures. Any short-term impact would be mitigated by closely following the herbicides manufactures recommended temperature range for appropriate herbicide applications.

Restoration activities, such as removing orchard trees or non-native trees, could result in temporary increases of chainsaw or vehicle exhaust, emissions, and fugitive dust in the general project area. Any exhaust, emissions, and fugitive dust generated from restoration activities would be temporary and localized and would likely dissipate rapidly because air stagnation at Aztec Ruins National Monument is rare. Overall, the project could result in a negligible degradation of local air quality; such effects would be temporary, lasting only as long as restoration activities are being conducted. The Class II air quality designation for Aztec Ruins National Monument would not be affected by the proposal; therefore, air quality has been dismissed from further consideration.

Climate Change and Sustainability

Although climatologists are unsure about the long-term results of global climate change, it is clear that the planet is experiencing a warming trend that affects ocean currents, sea levels, polar sea ice, and global weather patterns. Although these changes would likely affect winter precipitation patterns and amounts in the parks, it would be speculative to predict localized changes in temperature, precipitation, or other weather changes, in part because there are many variables that are not fully understood and there may be variables not currently defined. Therefore, the analysis in this document is based on past and current weather patterns and the effects of future climate changes are not discussed further.

Wetlands

For regulatory purposes under the Clean Water Act, the term wetlands means "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas." Executive Order 11990 Protection of Wetlands requires federal agencies to avoid, where possible, adversely impacting wetlands. Further, Section 404 of the Clean Water Act authorizes the U.S. Army Corps of Engineers to prohibit or regulate, through a permitting process, discharge or dredged or fill material or excavation within waters of the United States. National Park Service policies for wetlands as stated in 2006 Management Policies and Director's Order 77-1 Wetlands Protection, strive to prevent the loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. In accordance with DO 77-1 Wetlands Protection, proposed actions that have the potential to adversely impact wetlands must be addressed in a Statement of Findings for wetlands. No wetlands are located in the project area; therefore, a Statement of Findings for wetlands would not be prepared, and the topic of wetlands has been dismissed from further consideration.

Museum Collection

According to Director's Order 24 *Museum Collections,* the National Park Service requires consideration of impacts on museum collections (historic artifacts, natural specimens, and archival and manuscript material), and it provides further policy guidance, standards, and requirements for preserving, protecting, documenting, and providing access to, and use of, National Park Service museum collections. No museum collections would be affected; therefore, the topic of museum collection has been dismissed from further consideration.

Soundscape Management

In accordance with 2006 Management Policies and Director's Order 47 Sound Preservation and Noise Management, an important component of the National Park Service's mission is preservation of natural soundscapes associated with national park units (NPS 2006). Natural soundscapes exist in the absence of human-caused sound. The natural ambient soundscape is the aggregate of all the natural sounds that occur in park units, together with the physical capacity for transmitting natural sounds. Natural sounds occur within and beyond the range of sounds that humans can perceive and can be transmitted through air, water, or solid materials. The frequencies, magnitudes, and durations of human-caused sound considered acceptable varies among National Park Service units as well as potentially throughout each park unit, being generally greater in developed areas and less in undeveloped areas.

The predominant soundscape at Aztec Ruins National Monument is comprised of mostly human-made sounds produced from vehicular traffic entering/leaving the park, people visiting or working at the park, and natural sounds, such as birds and wind. Other sounds may include climate controls, such as heating or air conditioning units. Also, sounds outside the Monument contribute to the soundscape in the Monument, such as traffic and neighborhood noise from the town of Aztec.

This project would not contribute to long-term impacts to the soundscape at Aztec Ruins National Monument. The proposed project would likely have temporary impacts to the soundscape while restoration activities are conducted, such as human-caused sounds from equipment, vehicular traffic, and people. Any sounds generated would be temporary, lasting only as long as the activity is producing the sounds and would have a negligible adverse impact on visitors and employees. Therefore, the topic of soundscape management was dismissed from further consideration.

Lightscape Management

In accordance with *2006 National Park Service's Management Policies*, the National Park Service strives to preserve natural ambient landscapes, which are natural resources and values that exist in the absence of human caused light (NPS 2006). There would be no effect to the current lighting scheme. Therefore, the topic of lightscape management was dismissed from further consideration.

Socioeconomics

The proposed action would neither change local and regional land use nor appreciably impact local businesses or other agencies. Implementation of the proposed action could provide a negligible beneficial impact to the economies of Aztec, New Mexico, due to minimal increases in revenues for local businesses generated from restoration activities. Any increase in workforce revenue, however, would be temporary and negligible, lasting only as long as the restoration activities occur. Because the impacts to the socioeconomic environment would be negligible, this topic has been dismissed from further consideration.

Prime and Unique Farmlands

The Farmland Protection Policy Act of 1981, as amended, requires federal agencies to consider adverse effects to prime and unique farmlands that would result in the conversion of these lands to non-agricultural uses. Prime or unique farmland is classified by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) and is defined as soil that particularly produces general crops, such as common foods, forage, fiber, and oil seed; unique farmland produces specialty crops, such as fruits, vegetables, and nuts. According to the NRCS, the project area does not contain prime or unique farmlands. Therefore, the topic of prime and unique farmlands has been dismissed from further consideration.

Indian Trust Resources

Secretarial Order 3175 requires that any anticipated impacts to Indian trust resources from a proposed project or action by the Department of Interior agencies be explicitly addressed in environmental documents. The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes. There are no Indian trust resources at Aztec Ruins National Monument. The lands comprising the Monument are not held in trust by the Secretary of the Interior for the benefit of Indians due to their status as Indians. Therefore, the project would have negligible effects on Indian trust resources, and this topic has been dismissed from further consideration.

Environmental Justice

Executive Order 12898 *General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. Because park resources are available for use by all people regardless of race or income, and the vegetation management and cultural landscape preservation maintenance workforces would not be hired based on their race or income, the proposed action would not have disproportionate health or environmental effects on minorities or low-income populations or communities. Therefore, environmental justice has been dismissed from further consideration.

Ethnographic Resources

National Park Service Director's Order 28 *Cultural Resource Management*, defines ethnographic resources as any site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it. According to DO-28 and Executive Order 13007 on sacred sites, the National Park Service should try to preserve and protect ethnographic resources. Aztec Ruins National Monument has not identified all possible traditional cultural properties within the Monument. However, the monument is in the process of conducting a Traditional Use Study, which would contribute to the future knowledge of this topic. In previous consultation with tribes, the park determined that, in general, all of the tribes associated with the area consider Aztec Ruins to be a sacred ancestral place. The impacts of this plan on ethnographic resources would be negligible; therefore, it has been dismissed from further consideration.

Geology and Topography

According to the National Park Service's *2006 Management Policies*, the National Park Service would preserve and protect geologic resources and features from adverse effects of human activity, while allowing natural processes to continue (NPS 2006).

The geology of Aztec Ruins National Monument, including details of formation and natural processes over time, is described in a scoping summary (KellerLynn 2007 and Gillam 1998 cited in KellerLynn 2007). Restoration activities, such as removing orchard trees or non-native trees, would not result in disturbance to the geology of the Monument; therefore, this topic has been dismissed from further consideration.

Park Operations

The proposed plan is expected to have minimal impact on park staff time and effort. Preservation and restoration work would be conducted by outside crews, such as the Colorado Plateau Exotic Plant Management team (NPS), Youth Conservation Corps crews, the Public Lands Crew, and the Fire Crew from Mesa Verde National Park (NPS). There would be no new positions within Aztec Ruins National Monument required to conduct the work or to supervise work crews. The time and effort that is currently spent with vegetation management, such as mowing along Ruins Road for weed control and hand-pulling bindweed from ruins walls, along with time and effort in requesting technical assistance of work crews is expected to be balanced by less time and effort required from a self-sustaining native plant community. Park Operations, therefore, has been dismissed as a topic for further consideration because the impacts would be negligible.

ALTERNATIVES CONSIDERED

During July of 2006, an interdisciplinary team of National Park Service employees met for the purpose of developing project alternatives. This meeting resulted in the definition of project objectives as described in the *Purpose and Need,* and a list of alternatives that could potentially meet these objectives. This Plan/Environmental Assessment evaluates three alternatives: Alternative 1 – No Action, which is used as a baseline assessment; Alternative 2 - Proactive Vegetation/Cultural Landscape Management, which includes using a comprehensive toolbox of mechanical, chemical, prescribed fire, and biological controls; and Alternative 3 – Limited Vegetation/Cultural Landscape Management, which includes a limited toolbox of mechanical and biological controls only. A summary table comparing alternative components is presented at the end of this chapter, along with a summary table of the impacts.

Current and Future Desired Conditions of Management Units

For the purposes of this Plan/Environmental Assessment, the Monument was divided into eight management units that correspond to the vegetation zones, representing areas of the Monument that would require different treatment or management prescriptions for vegetation and cultural landscapes. These management units are based on the vegetation composition of the area along with the presence of cultural landscapes. The management units include (1) Uplands and Slopes, (2) Old Fields and Cultivated Lands, (3) Core Cultural Area, (4) Riparian and Floodplain, (5) Farmers Ditch, (6) Aztec Ruins Historic District Landscape, (7) Fruit and Ornamental Trees, and (8) Park Developed Areas (Exclusive of Historic District). These units are defined below along with a description of the current condition and future desired conditions for each of these areas (refer to Fig. 1 for map of management units). The alternatives in the next section are described by the activities that would occur within each of the management units.

Uplands and Slopes

Definition – Upper Sonoran life zone dominated by big sagebrush, rabbitbrush, yucca, Utah juniper, piñon pine, and a variety of grasses, such as blue grama, prairie Junegrass (*Koeleria macrantha*), alkali sacaton, and Indian ricegrass, and woody species present in drainages.

The Uplands and Slopes management unit includes part of the Ancient Aztec Landscape. The natural topography influenced placement of structures and was modified to include earthen and cobble berms, terrace platforms or pedestals, swales, and roadways. The North Mesa Archeological District is located entirely on the Uplands and Slopes. It consists of a complex series of sites with both residential and public architecture that date to A.D. 1050-1300. The District is currently listed on the State Register of Cultural Properties and contains sites that are eligible for listing on the National Register of Historic Places.

Current Condition – There is a low diversity of native vegetation, which is recovering from historic grazing. Cheatgrass is established, and there are impacts from energy extraction activities, e.g., gas wells, gas well pads, and gas pipelines, and access roads. Also present are overhead power lines and poles, a surface gas gathering line, and barbed wire fencing. There are a few social trails, one abandoned well site, and an old homesite. Potholes have created disturbed areas in many archeological sites. The Ancient Aztec Landscape is in good condition with stable cultural resources and mostly native vegetation. Initial establishment of new crypto-biotic soil crusts s is evident.

Future Desired Condition – The desired future condition includes the following: (1) healthy robust, viable, self-sustaining Upper Sonoran life zone, (2) minimal presence of non-native species, (3) preservation of Chacoan Landscape (versus Vernacular Landscape characteristics), (4) a healthy occurrence of crypto-biotic soil crusts, (5) no overhead power lines and other visual intrusions, no surface pipeline, no non-historic push pile near North Ruin, and no fencing, gas well pads, or access roads, (6) archeological sites and Ancient Aztec Landscape in good condition with no potholes or active erosion, (7) no social trails,

and (8) added features, such as signs and structures, would be compatible with corresponding cultural landscape.

Old Fields/Cultivated Lands

Definition – Old pasture, scattered fruit trees and ornamentals and cultivated lands historically used for a variety of crops as well as grazing and agricultural activities, including irrigation. Agricultural and other uses stopped for most portions in mid to late 1990s. Homesite areas include the Hubbard home demolished in 2001, a mobile homesite south of Kiva Trading Post, and a trailer site on west side of Ruins Road south of Farmers Ditch. Most structures and features that were associated with historic farming activities (e.g., corrals, outhouse, chicken coop, fencing, irrigation ditches, and tailwater pond) are considered ineligible for the National Register, except for the Farmers Ditch. Also included are intact cultural sites and features that contribute to the Ancient Aztec Landscape, which individually are potentially eligible for the National Register.

Current Condition – The old fields and cultivated lands are dominated by non-native pasture grasses and a variety of non-native species. Scattered fruit trees, mostly near historic irrigation ditches, are not maintained or watered; most have dead wood and are in poor condition. Ornamentals, such as roses and non-native trees, are unmaintained and not watered. Russian olive trees are present along fence lines. Prairie dog populations fluctuate and have impacted subsurface cultural deposits. Lack of native vegetation supports an environment for non-native weed establishment. Historic irrigation ditches, agricultural fields, corrals, fencing, and the tailwater pond footprint exist in varying conditions. Various features of the Hubbard homesite that still remain include some concrete foundations and walls of below ground features, and outhouse. The concrete block foundation of the mobile home south of Kiva Trading Post was removed, but the sloped earth building site, leveled area, some small structures, and utility lines remain.

The Ancient Aztec Landscape in this section is in fair condition; past farming, prairie dog activity, and construction of historic and recent vernacular features have all had major impacts on this landscape. The Historic Vernacular landscape is in poor condition due to deteriorated condition of wood fencing, corrals, and buildings as well as the lack of healthy agricultural crops.

Future Desired Condition – The desired future condition includes the following: (1) a more natural appearing landscape that is more compatible with the Ancient Aztec Landscape, (2) an open shrubland, including a diversity of native grasses and forbs that are more compatible with the Ancient Aztec Landscape and would have the greatest success in becoming established, (3) control of non-native species, (4) noxious (invasive) weeds do not adversely impact native species and are eradicated when feasible, (5) the Ancient Aztec Landscape is in good condition, (6) vegetation of the residential homesites areas is restored to native species as appropriate, (7) irrigation ditches do not interfere with natural surface water flow, (8) physical and visual impacts from historic activities to archeological resources are minimized, and condition of archeological resources is good, (9) no recently placed items or scrap unassociated with the Historic Vernacular Landscape, (10) no recent visual intrusions, such as overhead power lines, (11) reclamation of old Ruins Road and dirt roads not needed for management purposes, (12) added features, such as signs and structures, would be compatible with corresponding cultural landscape.

Core Cultural Area

Definition – Original monument of approximately 25 acres, excluding Aztec Ruins Historic District and administrative area. West Ruin is the primary interpretive exhibit with an interpretive trail for visitors.

Current Condition – The Ancient Aztec Landscape is in fair condition due to preservation needs of East and West Ruins. A mixture of native shrubs, grasses, and non-native species is present. Cottonwood and elm trees are present in some areas near ruins, and Russian olive and tamarisk are present near fence lines. Dense stand of shrubs, including greasewood (*Sarcobatus vermiculatus*), four wing saltbush

(*Atriplex canescens*), and rabbitbrush are present in the East Ruin area. Some areas of the West Ruin have been backfilled, and non-native species exist on the fill. Historically plowed areas are present around major ruins and areas where NPS modified earth contours for drainage and appearances. Modern visual intrusions and modifications in this and other zones that may affect this zone include trees, altered density and distribution of native vegetation, drainage pipes, overhead power lines, fence lines, old road beds, and buildings.

Future Desired Condition – Ancient Aztec Landscape features are the management priority within this zone. The desired future condition includes the following: (1) Ancient Aztec Landscape is in good condition, (2) shrubs are minimized on and immediately adjacent to cultural resources, (2) native grasses dominate on and around cultural resources, (3) non-native species are controlled, (4) existing cottonwood groves are only maintained and replaced as needed to meet management objectives, (5) elm trees are eliminated to meet management objectives, (6) visual intrusions are removed or mitigated where possible, (7) historically modified earth contours are restored to original contours, and (7) added features, such as signs and structures, would be compatible with corresponding cultural landscape.

Riparian/Floodplain

Definition – Active 100 year flood plain along the west side of the Animas River. Vegetation is under the direct influence of groundwater and over-stream flow. The riparian/floodplain includes both the Ancient Aztec Landscape and Historic Vernacular Landscape. Historic features include fencing, small irrigation laterals, and building remnants.

Current Condition – The dominant overstory consists of Russian olive, box elder, tamarisk, and to lesser extent cottonwood. Understory vegetation is a mixture of willows, western wheat grass, and a variety of non-native species, including maple (*Acer* spp.) trees and cultivars. Non-natives are adversely impacting native vegetation by outcompeting natives for limited resources. Historic fencing and building remnants are in poor to fair condition.

Future Desired Condition – The desired future condition includes the following: (1) riparian zone and floodplain are supported by natural functioning processes and these processes are sustainable, (2) riparian area is dominated by mixed aged native species of box elder, ash, and cottonwood, (3) the floodplain vegetation is dominated by native willows, native grasses, and riparian forbs, (4) tamarisk and Russian olive are not displacing native species, (5) vegetative/watershed restoration demonstration area serves as a model for neighbors, (6) vegetation compatible with Ancient Aztec Landscape is emphasized, and (7) added features, such as signs and structures, would be compatible with corresponding cultural landscape.

Farmers Ditch

Definition – Historic Farmers Ditch and 50 foot right of way on each side of the ditch. Four archeological sites are present. The Farmers Ditch has been determined eligible for the National Register.

Current Condition – Soils are frequently disturbed by maintenance of the open ditch. There is an access road along ditch. Cleared vegetation from ditch banks are frequently piled along road. Dominant vegetation is non-native with distinct populations of several exotic species: common kochia, Russian thistle, tumble mustard, cheatgrass, and Russian olive. The Farmers Ditch hydrologically interrupts surface water flow from the north uplands and slopes to the south.

Future Desired Condition – The desired future condition includes the following: (1) natives are dominant vegetation species, (2) no new non-native populations are established, (3) control and containment of weeds as feasible, (4) vegetation debris is cleared, and (5) added features, such as signs and structures, would be compatible with corresponding cultural landscape.

Aztec Ruins Historic District Landscape

Definition – A 2.35 acre landscape that includes the Monument entrance, parking lot and enclosing stucco walls, Visitor Center, nearby rock irrigation ditch on north side of building, picnic grounds, courtyard north of visitor area enclosed by stucco walls, and fishpond outline. The Aztec Ruins Historic District is eligible for the National Register. The Visitor Center is individually eligible for the National Register.

Current Condition – The Aztec Ruins Historic District is in fair condition due to existence of non-native plants and poor condition of the irrigation ditch north of the rear patio. Stucco perimeter walls and the Visitor Center are in good condition due to recent treatments. Front and back lawns are Kentucky bluegrass (*Poa pratensis*) that are watered and mowed but are considered noncontributing or historically incompatible. There are patches of native vegetation on the front lawn and in picnic areas. Vegetation in the picnic area is predominantly buffalograss; blue grama dominates the western third, and smooth brome and orchard grass interspersed with blue grama dominates the remainder. Non-native grasses are competing with native grasses. Cottonwoods and non-native Siberian elms trees shade the picnic area and parking lot. Mature cottonwoods are declining, and there is no cottonwood regeneration. Hazardous trees and limbs are present. Non-native ornamental junipers are trimmed. Noncontributing vegetation to the Aztec Ruins Historic District includes entrance and patio lawn, non-native shrubs, and Siberian elm trees in the picnic grounds. Contributing vegetation includes native grasses and native cottonwoods in the picnic grounds and native plantings in front of Visitor Center.

Future Desired Condition – The desired future condition includes the following: (1) integrity and condition of Aztec Ruins Historic District are improved to good condition, (2) non-contributing vegetation is replaced with contributing native vegetation, (3) all contributing buildings and structures, including walls, within the Aztec Ruins Historic District continue to be maintained in good condition, (4) rock-lined irrigation ditch is maintained in good condition, (5) native vegetation types known to aggravate allergies and asthma would be avoided to increase visitor and employee safety, visitor enjoyment, and employee productivity, and (6) added features, such as signs and structures, would be compatible with corresponding cultural landscape.

Orchards

Definition – Orchards include a pear orchard of about 157 trees in old fields west of West Ruin, an apple orchard of about 50 trees in old fields west of West Ruin and an apple orchard of about 30 trees and some pears associated with the riparian flood plain. Documentation of the genotypes of varieties of the orchard species has not been acquired.

Current Condition – The pear orchard is not maintained. Many of the pear trees are dead or dying with a lot of dead wood present. Consistent irrigation is creating wetland type vegetation in understory of pear orchard. The apple orchard west of West Ruin is unmaintained. Some past over-irrigation has killed about a dozen trees. About 25-30 apple trees are alive with many of them having dead wood present. Several apple trees are dead and down. Past over-irrigation in a portion of the apple orchard created wetland type vegetation (cattails, *Typha* spp.) in the understory. In the riparian zone, the apple orchard (some other fruit varieties are present) is unmaintained and declining. About half the trees are alive with a lot of dead wood present. Some apple trees in the riparian zone are dead and down. The pear orchard is about 60 years old, the apple orchard to the NW about 80 years old.

Future Desired Condition – The desired future condition includes the following: (1) a more natural appearing landscape that is more compatible with the Ancient Aztec Landscape, and (2) open shrubland dominated by a diversity of native grasses and forbs.

Park Developed Areas (Exclusive of Aztec Ruins Historic District)

Definition – Park Developed Areas include Mission 66 maintenance office and shop, modern administrative trailer, paved parking lots and roads and sidewalks, overhead utility lines and poles,

abandoned Ruins Road bed, a triple wide trailer occupied under lease arrangement, outdoor work areas associated with maintenance area, and the road to the Hubbard homesite. The Kiva Trading Post, constructed in 1960, has not been evaluated for National Register eligibility. The Aztec Ruins Trading Post is ineligible.

Current Condition – The maintenance office and shop are in good condition. The Kiva parking lot is in poor condition with cracks. Road and sidewalks are in good condition, with portions just established within the past few years. The Kiva Trading Post is in poor condition. Non-native and some invasive species of vegetation dominate most of the facilities in this area. Ornamentals, such as lilac and roses, are not maintained. Some fruit trees are present and not maintained. The Aztec Ruins Trading Post condition is poor. Overhead utility lines and poles are in functioning condition. The road to the Hubbard homesite is gravel. Abandoned Ruins Road has non-native weeds in the fields next to the roadbed; the roadbed has old asphalt and harbors non-native plants as well as rabbitbrush and cottonwood.

Future Desired Condition – The desired future condition includes the following: (1) developed area would be landscaped with compatible native vegetation when feasible and appropriate, (2) developed area does not detract from Aztec Ruins Historic District Landscape, (3) old trading posts are adaptively reused and made visually compatible with Aztec Ruins Historic District, (4) control and removal of non-native vegetation where deemed appropriate by management, (5) vegetation of the residential homesite areas are restored to native regime as appropriate, (6) visual intrusions, such as overhead utility lines, the administrative trailer, and the road to the Hubbard homesite, are minimized, and (7) added features, such as signs and structures, would be compatible with corresponding cultural landscape.

Elements Common to the Action Alternatives

Cultural Treatments: Practices that promote the growth of desirable plants and reduce the opportunities for exotic plants to establish and grow. Examples include irrigation and seeding of native plant species.

Mechanical Treatments: Physical damage to or removal of part or all or of the plant. Examples include hand pulling, cutting, grubbing, and mowing.

Biological Treatments: Biological control or bio-control includes the use of “natural enemies”, such as insects and microorganisms to reduce the abundance of an exotic plant. Natural enemies are usually imported from areas where the target exotic plant occurs as a native plant and are deliberately released into areas where the plant is exotic. Examples include plant-feeding insects such as Tamarisk leaf beetles (*Diorhabda elongata deserticola*) for tamarisk (*Tamarix* spp.), puncturevine weevils (*Microlarinus spp*.) for puncturevine *(Tribulus terrestris)* and leaf beetles (*Galerucella* spp.) for purple loosestrife (*Lythrum salicaria*). Approved biological agents will be host-specific and have a negligible risk for becoming a pest.

Chemical Treatments: applying herbicides as prescribed by their labels, using a variety of application methods. Examples of application methods include portable sprayers and vehicles equipped with sprayers.

Prescribed Fire Treatments: applying fire to a predetermined area to reduce the growth of exotic plants and to increase the growth of desirable plants. In this plan, prescribed fire treatments will be only be used to burn brush piles of exotic vegetative debris like tamarisk and heat treatment on individual or small populations of emerging plants. Individual treatments or combinations of those treatments would be implemented as appropriate to control and exotic plants in AZRU. Park would cooperate with state, county, private, tribal, and federal officials.

Under the preferred alternative, the following treatment methods are proposed to manage exotic plants. These treatments include:

• Cultural
• Mechanical
• Biological Control
• Chemical
• Prescribed Fire
Each of these treatments is discussed in the following sections.

Cultural Treatments

Cultural treatments are practices that promote the growth of desirable plants and reduce the opportunities for exotic plants to grow. Cultural treatment methods involve manipulating treatment areas to present exotic plants with effective native competitors. Examples of cultural treatments that may be implemented under the preferred alternative include:
• Prevention
• Reseeding and Planting
• Irrigation

Prevention

Preventing establishment is an economical way to manage exotic plants. Under the preferred alternative, the following prevention actions would be implemented:

• Any mulch, fill, gravel, and other like materials brought into a park should be certified free of exotic plant seed (“certified weed-free”).

• Sources of “clean fill” (weed-free) will be used, where available. If not feasible, fill not designated as “clean fill” may be used but should be closely monitored for exotic plant growth. Construction equipment will otherwise avoid exotic plant infestations, to the extent feasible.

• Any seed or plant materials used for restoration efforts within a park should be “certified weed-free”.

• Require inspections and cleaning of contractors’ and fire fighters’ equipment, vehicles, and materials to prevent importation of nonnative plant seed or materials into a park.

• Require commercial users that disturb established vegetation to provide bonds that are retained until sites are returned to a specified condition.

• Develop BMPs to limit the amount and impact of ground-disturbing activities.

• Train park staff and volunteers on how to identify priority exotic plants. Park employees and volunteers should report any observations of exotic plants to the resource manager immediately. A phone number for the point of contact would be provided to staff and volunteers.

• Develop information for the public and park staff on exotic plants. This information may include signs, interpretive displays, brochures, and programs.

Reseeding and Planting

Reseeding is used to encourage the re-establishment of native plants and to prevent the establishment of exotic plants. Native shrubs or trees can also be replanted after exotic shrubs and trees are removed to help restore habitat structure. Unless native plants are reestablished, the removal of one exotic plant may result in the establishment of another undesirable exotic plant. Reseeding will not be required in areas where native plant diversity is good within and surrounding treated infestations of exotics.

Under the preferred alternative, any planned in-park development or disturbance activities should be required to include sufficient time for plant salvage to be completed prior to disturbance. Any areas that are disturbed would be reseeded as soon as possible to facilitate the reestablishment of native plants. Restoration may also be necessary in dense infestation areas that no longer support native

species or where viability of native species seed banks has been exhausted. Following treatment and removal of exotic plants, these areas will be reseeded using native plant materials. Any materials used in re-vegetation (including mulch and organic fertilizers) would be free of non-native plant seeds or materials. In addition, locally grown, native plant materials would be used where possible. All plant materials used would be "certified weed-free."

Irrigation

Irrigation may be used on a limited basis to help native vegetation become established during dry periods however, no surface water depletions or accretions related to irrigation would occur under the preferred alternative. Because much of the AZRU area has been in a drought over the last several years, any projects that involve planting native shrubs or trees should also consider whether there would be adequate water to facilitate vegetation establishment. If drought conditions are forecasted, resource managers should delay the purchase and planting of shrubs to avoid the need for irrigation. Resource managers should also confirm that there is water available for irrigation should the need arise.

Manual and Mechanical Treatments

Mechanical treatments would involve the use of tools to remove or physically damage exotic plants. Examples of mechanical treatments include using hand cutting (shovels and clippers), pulling tools (such as weed wrenches™), and power tools. Any mechanical methods would be highly selective for individual plants. Mechanical treatments could be used to treat individual plants or specific treatment areas. Mechanical treatments may need to be performed several times during a season and are often used in concert with other treatment methods. For example, mechanical treatments may be followed by application of herbicides to treat re-sprouts and new seedlings. Mechanical treatments remove aboveground biomass and deplete nutrient reserves that are stored in root or rhizome systems. Once nutrient reserves are depleted, exotic plants become more susceptible to subsequent chemical treatments. Following biomass removal, chemicals are often applied directly to the stumps to prevent suckering. Activities with minimal surface disturbance, such as no-till drill seeding, might be used to reseed areas in the future. Any activities that could disturb wetlands or waters of the U.S. would require separate consultation with the USACE to determine if a permit is needed.

Biological Control

Biological control relies on the use of other biological organisms to maintain pest populations below the action thresholds. In some cases, such as when native insects and herbivores are not maintaining exotic plants at acceptable levels, releases of biological control agents may be necessary. Release of biological control agents adhere to the following BMPs: • Biological control agents should be released in each climatic zone that is occupied by the host so that the natural enemy has a chance to develop in all areas where the host occurs.

• The number of biological control agents released should account for the size and density of the treatment area and the number of agents required to maintain a viable biological control agent population.

• More than one release in an area may be necessary for successful establishment.

• Releases should be synchronized with the time period when the host is present.

• Biological control agents should be released at times of the day when they will not disperse from the treatment area.

• Surveys for biological control agents should be completed several times during the season to monitor biological control agents.

Under the preferred alternative, insects would be the primary biological control agent that would be used.

Chemical Treatments

Chemical treatments involve applying herbicides as prescribed by their labels, using a variety of application methods. Herbicides are most effective for treating pure stands of a single exotic plant species in areas where desirable plants are scarce or absent. Herbicides can also be used to treat small patches of exotic plants where hand pulling or cutting is not feasible.

Prescribed Fire Treatments

Prescribed fire treatment would be used for individual burns for disposal of vegetative debris that is infeasible to dispose of by other means. Under this alternative, brush piles that accumulate from cutting of exotic plants such as tamarisk (*Tamarix chinensis*) and Russian thistle (*Salsola tragus*) would continue to be burned. Heat treatments of individual or small populations of emerging plants, particularly puncturevine (*Tribulus terrestris*) and Russian thistle (*Salsola tragus*) may also be used under this alternative.

Description of Alternatives

The overall goal of this Vegetation Management and Cultural Landscape Preservation Maintenance Plan/ Environmental Assessment is for the vegetation at the Monument to be dominated by self-sustaining native species, which would require minimal maintenance. Three alternatives have been considered: (1) no action, (2) proactive vegetation/cultural landscape management, and (3) limited vegetation/cultural landscape management.

Alternative 1 – No Action

Alternative 1 (No Action) would maintain current management actions within the Monument. No treatments of non-native vegetation would occur, and no active restoration of vegetation or cultural landscapes would occur. This alternative will result in continued increase of non-native plants and loss of diversity through native species loss. This will meet none of the desired results. Following are descriptions of activities currently taking place in each management unit.

Uplands and Slopes –
Activities that currently occur and would continue to occur in the uplands and slopes under the No Action Alternative include (1) gas well operations, including road maintenance and gas well maintenance, (2) archeological preservation and condition assessment, (3) maintenance by utility companies, and (4) monitoring and research.

Old Fields/Cultivated Lands –
Activities that currently occur and would continue to occur in the old fields and cultivated lands under the No Action Alternative include (1) archeological preservation and condition assessment, (2) maintenance by utility companies, (3) maintenance of lateral ditches, (4) no active restoration of historical structures or vegetation, and (5) cattle grazing by adjacent property owner and flood irrigation by adjacent property owner.

Core Cultural Area –
Activities that currently occur and would continue to occur in the Core Cultural Area under the No Action Alternative include (1) visitor use, primarily on existing trails, (2) archeological preservation and condition

assessment, (3) fire management, including fuels reduction, (4) stock piles for preservation work (e.g., soil), (5) no road maintenance other than passive restoration, (6) restricted use of roads (used for preservation work), (7) removal of weeds from ruin walls, (8) berm ruin walls and add chips from fuels reduction, and (9) targeted application of herbicide for bindweed on ruin walls.

Riparian/Floodplain –
Activities that currently occur and would continue to occur in the riparian zone/floodplain under the No Action Alternative include (1) maintenance by utility companies, (2) trespassing for fishing, and (3) archeological preservation and condition assessment.

Farmers Ditch –
Activities that currently occur and would continue to occur along the Farmers Ditch under the No Action Alternative include (1) targeted herbicide application for invasive weeds, and (2) maintenance of Farmers Ditch by the ditch company.

Aztec Ruins Historic District Landscape –
Activities that currently occur and would continue to occur in the Aztec Ruins Historic District Landscape under the No Action Alternative include (1) on-going maintenance of structures as needed, (2) irrigation of vegetation at picnic area, (3) application of city water on grass at Visitor Center, (4) visitor use of lawns, (5) maintenance of lawns, including mowing, and raking of native vegetation, (6) maintenance of water lines, (7) maintenance by utility companies, and (8) maintenance of asphalt.

Historic Fruit Trees and Ornamentals –
Activities that currently occur and would continue to occur in the management zones with historic fruit trees and ornamentals under the No Action Alternative include (1) no water to orchards, and (2) no replacement of trees, allowing orchards to decline.

Park Developed Areas (Exclusive of Aztec Ruins Historic District) –
Activities that currently occur and would continue to occur in the Park Developed Areas (Exclusive of the Aztec Ruins Historic District, considered independently above) under the No Action Alternative include (1) limited mowing of yard areas, (2) limited watering of lawns, and (3) removal of hazard tree limbs.

Alternative 2 – Proactive Vegetation/Cultural Landscape Management

This alternative (Proactive Vegetation/Cultural Landscape Management), is the preferred alternative. It considers treatment of non-native vegetation using the entire tool box (mechanical, biological, cultural, prescribed fire, chemical) as well as restoration of vegetation and the cultural landscape. This alternative would restore native plant communities, resulting in restoration of natural ecological processes, including native wildlife communities, riparian/floodplain health, water resources, and soil resources. It would also enhance visitor experience and help protect cultural resources that are the foundation of the Monument. By actively restoring appropriate vegetation, this alternative will also result in the restoration of the cultural landscapes and therefore, maximally meet the desired conditions. Following are descriptions of activities that would take place under this alternative in each management unit.

Uplands and Slopes –
Activities that would occur in the uplands and slopes under the Proactive Vegetation/Cultural Landscape Management Alternative include (1) augmenting native species through replantings and seeding while minimizing soil intrusion, (2) where possible, using irrigation water sparingly and short-term to establish transplants and seeds, (3) actively restoring more natural conditions to evoke the Ancient Aztec Landscape (regrading pushpile and other recently-created topographic features, regrading well pads and access roads, regrading, scarifying, and revegetating dirt roads, backfilling potholes and other disturbed areas, removing aboveground utilities, cleaning up remaining modern homesite remains, and actively revegetating modern homesite and road), (4) treating non-native vegetation using mechanical (e.g., hand removal, limited bulldozer work, chainsaws, shovels), biological (insects), cultural (goats), prescribed fire and/or chemical tools, (5) prioritizing non-native management, with noxious weed treatment generally receiving higher priority than other non-natives (this is detailed in Appendix B, Invasive Plant

Management Plan), (6) conducting inventories and monitoring for early detection of new non-native species, (7) monitoring non-native treatments for efficacy, (8) monitoring to ensure no new social trails or erosion and close new social trails, and (9) verifying that well pad related activities and old homesites are restored consistent with above.

Old Fields/Cultivated Lands –
Under this alternative, the area is not fully restored, but rather partially restored, to the Ancient Aztec Landscape. Activities that would occur in the old fields and cultivated lands under the Proactive Vegetation/Cultural Landscape Management Alternative include (1) removing and/or recontouring irrigation ditches where they impede surface water flow, reclaiming disturbed areas where homesites existed, stimulating germination of seed bank, using vegetative barriers to manage prairie dog colonies, avoiding additional ground disturbance for irrigation of vegetation actions, (2) seeding and planting with native species, using irrigation water sparingly and short-term to establish transplants and seeds, (3) protecting subsurface cultural materials with consideration of plow zone depth and other factors, (4) removing highly visible remains from Historic Vernacular landscape (fencing, outbuildings, corrals, and agricultural features), recontouring, regrading and scarifying, revegetating dirt roads and old Ruins Road bed (see reference map for location of roads), (5) backfilling and/or revegetating eroding archeological sites as appropriate, (6) removing overhead power lines and above ground utility lines, (7) treating non-native vegetation using mechanical (e.g., hand removal, limited bulldozer work, chainsaws, shovels), biological (insects), cultural (goats), prescribed fire and/or chemical tools, (8) monitoring non-native treatments for efficacy, (9) prioritizing non-native management, with noxious weed treatment generally receiving higher priority than other non-natives, eliminating elm trees (Priorities are detailed in Appendix B, Invasive Plant Management Plan), (10) conducting inventories and monitoring for early detection of new non-native species, and (11) erecting fencing as appropriate to restrict livestock grazing.

Core Cultural Area –
Activities that would occur in the Core Cultural Area under the Proactive Vegetation/Cultural Landscape Management Alternative include (1) aggressively treating ruin mounds, revegetating steep slopes, mechanically removing shrubs and brush from ruin walls and adjacent areas, chemically treating stumps, monitoring in future years, (2) selectively removing shrubs on archeological resources, reseeding with native grasses, using irrigation water sparingly and short-term to establish transplants and seeds, (3) removing tailwater drainage pipe and recontouring site as appropriate, (4) removing structures and activities or screening visual intrusions, such as planting trees to screen maintenance area from visitor trails, maintaining and replacing as needed the existing cottonwood trees, recontouring, scarifying, and reseeding dirt road beds as appropriate (see reference map), (5) removing elm trees, (6) treating non-native vegetation using mechanical (e.g., hand removal, limited bulldozer work, chainsaws, shovels), biological (insects), cultural (goats), prescribed fire and/or chemical tools, using chemical and mechanical treatments with sensitivity to cultural resources, (7) prioritizing non-native management, with noxious weed treatment generally receiving higher priority than other non-natives, eliminating elm trees (Priorities are detailed in Appendix B, Invasive Plant Management Plan, (8) conducting inventories and monitoring for early detection of new non-native species, and (9) monitoring non-native treatments for efficacy.

Riparian/Floodplain –
Activities that would occur in the Riparian Zone and Floodplain under the Proactive Vegetation/Cultural Landscape Management Alternative include (1) eradicating tamarisk and Russian olive using mechanical, biological, and chemical tools, using or removing woody debris from tamarisk and Russian olive eradication, (2) quantitatively monitoring eradication efficacy, (3) actively planting native woody shrubs and herbaceous vegetation, using irrigation water sparingly and short-term to establish transplants and seeds, (4) seeking cooperative opportunities, developing a restoration demonstration area/model/program/leadership and showcase efforts to others, protecting and maintaining beneficial natural processes, such as flooding, (5) removing features from Vernacular Landscape—building remains, fencing, outbuildings, (6) treating non-native vegetation using mechanical (e.g., hand removal, limited bulldozer work, chainsaws, shovels), biological (insects), cultural (goats or goats), prescribed fire and/or chemical tools, (7) prioritizing non-native management, with noxious weed treatment generally receiving higher priority than other non-natives (this is detailed in Appendix B, Invasive Plant

Management Plan), (8) conducting inventories and monitoring for early detection of new non-native species, and (9) monitoring non-native treatments for efficacy.

Farmers Ditch –
Activities that would occur along the Farmers Ditch under the Proactive Vegetation/Cultural Landscape Management Alternative include (1) working with partners (e.g., Ditch Company) to develop Best Management Practices, (2) using irrigation water sparingly and short-term to establish transplants and seeds, (3) treating non-native vegetation using mechanical (e.g., hand removal, limited bulldozer work, chainsaws, shovels), biological (insects), cultural (goats), prescribed fire and/or chemical tools, (4) prioritizing non-native management, with noxious weed treatment generally receiving higher priority than other non-natives (this is detailed in Appendix B, Invasive Plant Management Plan), (5) conducting inventories and monitoring for early detection of new non-native species, and (6) monitoring non-native treatments for efficacy.

Aztec Ruins Historic District Landscape –
The overall treatment is rehabilitation with partial historic restoration of this landscape. Activities that would occur in the Aztec Ruins Historic District Landscape under the Proactive Vegetation/Cultural Landscape Management Alternative include (1) aggressively removing noncontributing, non-native vegetation, such as Siberian elm and Rocky Mountain junipers (Juniperus scopulorum) , (2) removing blue grass sod and replacing with contributing native vegetation types, (3) using irrigation water sparingly and short-term to establish transplants and seeds, (4) minimizing vegetation impacts to archeological sites and Ancient Aztec Landscape, (5) replacing declining cottonwoods with native cottonwoods as appropriate for Aztec Ruins Historic District Landscape, replacing native cottonwoods in picnic area as needed, (6) researching and evaluating current plantings in back patio/courtyard and considering vegetation compatible with the historic landscape, removing wild roses and vegetation adjacent to stucco walls as appropriate for historic landscape, replacing Siberian elms with native cottonwoods as appropriate for historic landscape, (7) continuing cyclic maintenance of features—stucco walls and buildings, painting, parking lot paving, walkway and trail repair, (8) preventing hazard trees by removing dangerous limbs, (9) establishing native grasses in picnic area that do not require regular mowing, (10) restoring colors, textures and patterns of exterior stucco and paints wherever possible and appropriate (where there is supporting historic documentation), (11) treating non-native vegetation using mechanical (e.g., hand removal, limited bulldozer work, chainsaws, shovels), biological (insects), cultural (goats), prescribed fire and/or chemical tools, (12) prioritizing non-native management, with noxious weed treatment generally receiving higher priority than other non-natives (this is detailed in Appendix B, Invasive Plant Management Plan), (13) conducting inventories and monitoring for early detection of new non-native species, and (14) monitoring non-native treatments for efficacy.

Historic Fruit Trees and Ornamentals –
Activities that would occur in the management zones with historic fruit trees and ornamentals under the Proactive Vegetation/Cultural Landscape Management Alternative include removing orchard and ornamental trees according to guidelines in the General Management Plan (2010).

Park Developed Areas (Exclusive of Aztec Ruins Historic District) –
Activities that would occur in the Park Developed Areas (exclusive of the Aztec Ruins Historic District) under the Proactive Vegetation/Cultural Landscape Management Alternative include (1) relocating overhead utility lines to underground location, (2) minimizing visual intrusions by relocating or using of native vegetation screen, (3) treating non-native vegetation using mechanical (e.g., hand removal, limited bulldozer work, chainsaws, shovels), biological (insects), cultural (goats), prescribed fire and/or chemical tools, (4) using irrigation water sparingly and short-term to establish native transplants and seeds, (5) prioritizing non-native management, with noxious weed treatment generally receiving higher priority than other non-natives (this is detailed in Appendix B, Invasive Plant Management Plan), (6) conducting inventories and monitoring for early detection of new non-native species, (7) monitoring non-native treatments for efficacy, (8) restoring native vegetation where appropriate, (9) removing administrative trailer and restoring surrounding area as appropriate, and (10) maintaining existing structures and buildings as compatible with historic landscape.

Alternative 3 – Limited Vegetation/Cultural Landscape Management

This alternative (Limited Vegetation/Cultural Landscape Management) considers treatment of non-native vegetation using a partial tool box (mechanical, biological, cultural, prescribed fire, but no herbicides). This alternative also does not include active restoration of vegetation and the cultural landscape. This alternative would attempt to partially restore native plant communities, which may or may not result in partial restoration of natural ecological processes. Following are descriptions of activities that would take place under this alternative in each management unit. This alternative would be less costly by not carrying out active restoration or monitoring. This would also avoid the application of herbicide in the Monument. The result would be slower eradication of non-natives and restoration of native vegetation. Without active restoration, the cultural landscapes would not be restored to the desired condition. This alternative has a lower chance of success than alternative two and would only partially meet the desired conditions.

Uplands and Slopes –
Activities that would occur in the uplands and slopes under the Limited Vegetation/Cultural Landscape Management Alternative include (1) preserving and protecting existing native vegetation and allowing native vegetation to revegetate naturally, (2) treating noxious weeds using mechanical (e.g., hand removal, limited bulldozer work, chainsaws, shovels), biological (insects), cultural (goats), and/or prescribed fire tools, (3) prioritizing non-native management, with noxious weed treatment receiving higher priority than other non-natives (this is detailed in Appendix B, Invasive Plant Management Plan), (4) conducting inventories and monitoring for early detection of new noxious weeds, (5) monitoring noxious weed treatments for efficacy, and (7) monitoring to ensure no new social trails or erosion and close new social trails.

Old Fields/Cultivated Lands –
Under this alternative, the area is not fully restored, but rather partially restored, to natural vegetation communities and habitats that provide the visitor with a better understanding of the natural environment associated with life at Aztec. Activities that would occur in the old fields and cultivated lands under the Limited Vegetation/Cultural Landscape Management Alternative include (1) removing and/or recontouring irrigation ditches where they impede surface water flow, using vegetative barriers to manage prairie dog colonies, avoiding additional ground disturbance for irrigation of vegetation actions (2) planting with native shrubs predominately for prairie dog containment, using irrigation water sparingly and short-term to establish transplants, (3) retaining remains from Historic Vernacular landscape (fencing, outbuildings, corrals, and agricultural features) unless there is a management conflict (such as for safety), removing asphalt from the old Ruins Road bed (see reference map for location of roads), (4) backfilling and/or revegetating eroding archeological sites as appropriate, (5) removing overhead power lines and above ground utilities, (6) treating noxious weeds using mechanical (e.g., hand removal, limited bulldozer work, chainsaws, shovels), biological (insects), cultural (goats), and/or prescribed fire tools, (7) monitoring noxious weed treatments for efficacy, (8) prioritizing non-native management, with noxious weed treatment receiving higher priority than other non-natives, eliminating elm trees (Priorities are detailed in Appendix B, Invasive Plant Management Plan, (9) conducting inventories and monitoring for early detection of new noxious weed species, and (10) erecting fencing as appropriate to restrict livestock grazing.

Core Cultural Area –
Activities that would occur in the Core Cultural Area under the Limited Vegetation/Cultural Landscape Management Alternative include (1) aggressively treating ruin mounds, revegetating steep slopes, mechanically removing shrubs and brush from ruin walls and adjacent areas, monitoring in future years, (2) selectively removing shrubs on archeological resources, reseeding with native grasses, using irrigation water sparingly and short-term to establish transplants and seeds, (3) removing tailwater drainage pipe and recontouring site as appropriate, (4) removing structures and activities or screening visual intrusions, such as planting trees to screen maintenance area from visitor trails, maintaining and replacing as needed the existing cottonwood trees, recontouring, scarifying, and reseeding dirt road beds as appropriate (see reference map), (5) removing Siberian elm trees, (6) treating noxious weeds using mechanical (e.g., hand removal, limited bulldozer work chainsaws, shovels), biological (insects), cultural

(goats), and/or prescribed fire tools, using mechanical treatments with sensitivity to cultural resources, (7) prioritizing non-native management, with noxious weed treatment receiving higher priority than other non-natives, eliminating Siberian elm trees (Priorities are detailed in Appendix B, Invasive Plant Management Plan, (8) conducting inventories and monitoring for early detection of new noxious weed species, and (9) monitoring noxious weed treatments for efficacy, treating resprouts with mechanical cuts.

Riparian/Floodplain –
Activities that would occur in the Riparian zone and floodplain under the Limited Vegetation/Cultural Landscape Management Alternative include (1) eradicating tamarisk and Russian olive using mechanical methods, using or removing woody debris from tamarisk and Russian olive eradication, (2) monitoring eradication efficacy quantitatively, (3) seeking cooperative opportunities, developing a restoration demonstration area/model/program/leadership and showcase efforts to others, protecting and maintaining beneficial natural processes, such as flooding, (4) removing features from Vernacular Landscape—building remains, fencing, outbuildings only when they conflict with management objectives, (5) treating other noxious weeds using mechanical (e.g., hand removal, limited bulldozer work, chainsaws, shovels), biological (insects), cultural (goats), and/or prescribed fire tools, (6) prioritizing non-native management, with noxious weed treatment receiving higher priority than other non-natives (this is detailed in Appendix B, Invasive Plant Management Plan), (7) conducting inventories and monitoring for early detection of new noxious weed species, and (8) monitoring noxious weed treatments for efficacy.

Farmers Ditch –
Activities that would occur along the Farmers Ditch under the Limited Vegetation/Cultural Landscape Management Alternative include (1) working with partners (Ditch Company) to develop Best Management Practices, (2) treating noxious weeds using mechanical (e.g., hand removal, limited bulldozer work, chainsaws, shovels), biological (insects), cultural (goats), and/or prescribed fire tools, (3) prioritizing non-native management, with noxious weed treatment receiving higher priority than other non-natives (this is detailed in Appendix B, Invasive Plant Management Plan), (4) conducting inventories and monitoring for early detection of new noxious weed species, and (5) monitoring noxious weed treatments for efficacy.

Aztec Ruins Historic District Landscape –
Activities that would occur in the Aztec Ruins Historic District Landscape under the Limited Vegetation/Cultural Landscape Management Alternative include (1) removing noncontributing, non-native vegetation, (2) removing bluegrass sod and replacing with contributing native vegetation types, (3) using irrigation water sparingly and short-term to establish transplants and seeds, (4) minimizing vegetation impacts to archeological sites and Ancient Aztec Landscape, (5) replacing declining cottonwoods with native cottonwoods as appropriate for Aztec Ruins Historic District Landscape, replacing native cottonwoods in picnic area as needed, (6) researching and evaluating current plantings in back patio/courtyard and considering vegetation compatible with the historic landscape, removing wild roses and vegetation adjacent to stucco walls as appropriate for historic landscape, replacing elms with native cottonwoods as appropriate for historic landscape, (7) continuing cyclic maintenance of features—stucco walls and buildings, painting, parking lot paving, walkway and trail repair, (8) preventing hazard trees by removing dangerous limbs, (9) in picnic area establishing native grasses that do not require regular mowing, (10) restoring colors, textures and patterns of exterior stucco and paints wherever possible and appropriate (where there is supporting historic documentation), (11) treating noxious weeds using mechanical (e.g., hand removal, limited bulldozer work, chainsaws, shovels), biological (insects), cultural (goats), and/or prescribed fire tools, (12) prioritizing non-native management, with noxious weed treatment receiving higher priority than other non-natives (this is detailed in Appendix B, Invasive Plant Management Plan), (13) conducting inventories and monitoring for early detection of new noxious weed species, and (14) monitoring noxious weed treatments for efficacy.

Historic Fruit Trees and Ornamentals –
Activities that would occur in the management zones with historic fruit trees and ornamentals under the Limited Vegetation/Cultural Landscape Management Alternative include removing orchard and ornamental trees according to guidelines in the General Management Plan (2010).

Park Developed Areas (Exclusive of Aztec Ruins Historic District) –

Activities that would occur in the Park Developed Areas (exclusive of the Aztec Ruins Historic District) under the Limited Vegetation/Cultural Landscape Management Alternative include (1) relocating overhead utility lines to underground location, (2) minimizing visual intrusions by relocating or using of native vegetation screen, (3) treating noxious weeds using mechanical (e.g., hand removal, limited bulldozer work, chainsaws, shovels), biological (insects), cultural (goats), and/or prescribed fire tools, (4) using irrigation water sparingly and short-term to establish native transplants and seeds, (5) prioritizing non-native management, with noxious weed treatment receiving higher priority than other non-natives (this is detailed in Appendix B, Invasive Plant Management Plan), (6) conducting inventories and monitoring for early detection of new noxious weed species, (7) monitoring noxious weed treatments for efficacy, (8) restoring native vegetation where appropriate, (9) removing administrative trailer and restoring surrounding area as appropriate, and (10) maintaining existing structures and buildings as compatible with historic landscape.

Alternatives Considered and Dismissed

A fourth alternative was considered but dismissed from further study because it did not meet the purpose and objectives of the plan. This alternative and why it was dismissed is discussed below.

Alternative 4 – Mechanical, cultural, and prescribed fire treatment of non-native vegetation.

An alternative using only mechanical and cultural treatment was considered but was eliminated from further analysis because of the efficiency and efficacy of both chemicals and biological for treating some exotic plants. In some instances, chemical treatment may be the only feasible method available for reducing the threat of exotic plants to environmental and cultural resources. According to NPS Management Policies, the use of herbicides is to be considered only when “all other available options are either not acceptable or not feasible.” In the consideration of biological control, NPS Management Policies (2006:47) states, “Exotic species will not be allowed to displace native species if displacement can be prevented.” In some instances, biological control may be the only feasible method available for reducing the threat of exotic plants to environmental and cultural resources.

Two topics within the considered alternatives were discussed and dismissed.

Restoring fishpond – This topic was discussed and dismissed for the following reasons: (1) it is unknown whether the fishpond still exists buried under the patio, and determining so would require excavation adjacent to the Visitor Center near dozens of ancient structures and kivas, (2) water features are harmful to subsurface archeological resources and the Monument’s primary resource—ruins due to water saturation, and (3) the fishpond would be a visual distraction.

Restoring tailwater pond – This topic was discussed and dismissed for the following reasons: (1) water features are harmful to subsurface archeological resources, (2) the Monument’s primary resource—East Ruin is down slope from the tailwater pond, (3) the tailwater pond would be a visual distraction, and (4) also was considered and dismissed in the 1988 GMP which called for eliminating it.

Mitigation Measures

The following mitigation measures would be used to minimize the effects of preservation and restoration activities and would be adhered to during implementation of the preferred alternative:

- All work would be conducted using best management practices and planned with the best available science.

- All work would be led by National Park Service professionals trained in historic preservation and restoration ecology. The Monument's cultural resource manager/archeologist and natural resource specialist

would coordinate the project and monitor all disturbance activities.

• To minimize the potential impacts from personnel and equipment, the following general mitigation measures would be implemented under both alternatives.

General

• Equipment would use existing roads and trails to the maximum extent practical.

• Herbicides will be applied by backpack sprayers or hand sprayers.

• Herbicides would be applied according to application rates specified on the product label.

• Hand tools will be primarily used and only where hand tools are not feasible, chainsaws may be used.

• Equipment used for exotic plant management would be washed prior to entering a park to reduce the potential for accidentally introducing exotic plants from another area.

• Use of equipment in high visibility areas would be avoided to the extent feasible.

• The number of vehicle and equipment passes off-road (only on a case by case basis) would be minimized to the extent possible.

• NPS policy requires that only herbicides that are expected to be used in a 1-year period can be purchased at one time. Therefore, herbicides would not be stored for periods greater than one year. Herbicide efficacy is lost over time.

Air Quality

• Reduced application rates of herbicides would be used wherever possible. Reduced application rates are often more effective than higher application rates because translocation is enhanced prior to loss of physiologic function. Higher rates may burn off leaves and reduce translocation.

• Herbicide application would account for meteorological factors such as wind speed, wind direction, inversions, humidity, and precipitation in relation to the presence of sensitive resources near the treatment area and direction provided on labels. Herbicides would only be applied when meteorological conditions at the treatment site allow for complete and even coverage and would prevent drifting of spray onto non-target sensitive resources or areas used by humans.

Soils

• Vehicles used for control will avoid wetland areas with standing water or saturated soils, to the extent practical and will be operated to minimize disturbance to soils.

• Personnel and equipment would avoid areas having sensitive biological soil crusts, especially those including colored lichen, or areas that are prone to erosion.

• Off-road vehicles will not be operated where there are well-developed soil crusts, especially where there are mature soil crusts including colored (yellow, white, red, green, brown or blue) soil lichens.

• Damage to soils will be minimized by using existing access routes, when possible, avoiding sensitive biological soil crusts, especially those including colored lichens.

• Type of mowing equipment will be selected based on the patch size, density of the target species, and

terrain and condition of biological soil crusts. Large, dense patches are suitable for vehicle-drawn mowing equipment, while small, dispersed patches are more suitable for control with hand-held equipment, such as a weed-whip.

- Hand raking will be used in smaller-scale sites if there are potential impacts to desirable vegetation or soil crusts.

- Where soil destabilization is not desired, the full removal of root systems will not be employed.

- Herbicides with longer persistence would be applied at lower concentrations and with less frequency to limit the potential for accumulation of herbicides in soils.

- When and where appropriate, soil amendment practices may be implemented. NPS (2006) requires that if off-site soil or soil amendments are used that removal of these soils and amendments should not disturb pristine sites. The use of soil amendments and fertilizers would not unacceptably affect the biological, chemical or physical characteristics of the soil.

- When temporary impacts associated with restoration activities are expected to disturb soils, the following materials may be used to reduce erosion and to retain top soils: silt fences, sand bags, wood excelsior, and weed-free or sterilized straw. When and if these materials are used, they would be inspected at least weekly, or as weather requires (e.g., after major storms) for condition and maintenance.

Wildlife

- The National Park Service would ensure that all preservation and restoration workers and supervisors are informed about wildlife values and regulations.

- Preservation and restoration activities would be scheduled to minimize impacts to wildlife to the greatest extent possible. Vegetation would be checked before chemical treatments for presence of wildlife, including nests, dens, and burrows. The Migratory Bird Treaty Act (1918) prohibits the take of nests, eggs, and nestlings; therefore, chemical treatments would be timed to avoid such take where nests are detected.

Native Vegetation

- Exotic plant management activities would only be used where necessary to promote the reestablishment of native plant communities.

- Eradicated trees can be chipped and used for mulch to control soil erosion and to retain local nutrients.

- To minimize the amount of ground disturbance, staging and stockpiling areas would be located in previously disturbed sites, away from visitor use areas to the greatest extent possible. Existing native vegetation at the site would be undisturbed to the greatest extent possible.

- All mowing activities will be timed so that they are performed before there is a danger of contributing to the spread of viable seed.

- Cut plant material will be removed from the site if it may prevent establishment/growth of desirable vegetation and appropriately transported and disposed of in a way so that no propagules are spread. If plant material can or must be left, it will be piled or scattered in a way that it does not re-root or interfere with desirable vegetation.

- Re-vegetation will be implemented as quickly as possible to large areas of bare soil to reduce the danger of erosion caused by any loss of vegetative cover. Small areas that are adjacent to healthy native vegetation will be allowed to recover naturally, whenever possible.

- Selection of restoration species will be limited to native species that exist naturally in the region to prevent

the accidental introduction of new exotic species. To minimize genetic contamination, propagules will be collected or propagated from the closest sites possible, as long as the collection site remains healthy and resilient to future disturbance. The benefits of local propagule collection must be weighed against the need for prompt revegetation. In many cases it may be more important to prevent establishment of non-desirable species and stabilize soils than to wait for sufficient seed to be collected locally.

- To limit the potential for equipment to spread exotic plant seeds, treatments should be completed before seed becomes viable.

- Planning will be utilized to assure that appropriate seed is available at the necessary time, and local collections will be prioritized based on available information concerning each species' genetic site-specificity.

- Parks would identify traditional use plants based on consultation with tribes.

- Traditional use plants are plants used or held sacred by Native American Tribes for medicinal, ceremonial, religious, or other cultural purposes.

- NPS staff would receive training on identification of traditional use plants and would avoid treating non-target plants to the extent feasible.

- Mechanical methods such as tilling would not be used in areas where traditional use plants are known to occur or have the potential to occur.

- Herbicides would be selected and BMPs would be implemented to maximize the effectiveness of the treatment on the target exotic plant and to minimize the potential effects on non-target plants.

- Herbicides would be applied as near to the target plant as possible.

- Herbicides would be applied at the appropriate time based on the herbicide's mode of action. Poor timing of application can reduce the effectiveness of herbicides and can increase the impact on non-target plants.

Water Resources (including wetlands and floodplains)

- If drought conditions are forecasted, resource managers should delay the purchase and planting of shrubs to avoid the need for irrigation. Resource managers should also confirm that there is water available for irrigation should the need arise.

- Vehicles are only permitted on established roads and will not be driven up or down stream channels. The number of vehicles will also be minimized to the extent possible.

- Applications of herbicides would be avoided during periods and in areas where seasonal precipitation or excess irrigation water is likely to wash residual herbicides into waterways.

- Only herbicides that are registered for use in or near water will be used in those areas.

- Only those herbicides that have a low potential toxicity, such as glyphosate (Roundup Pro and Rodeo) would be used within areas near surface waters or in areas with a high leaching potential. Glyphosate is strongly adsorbed into soil, with little potential for leaching to ground water. Microbes in the soil readily and completely degrade it even in low temperatures. It tends to adhere to sediments when released to water and does not accumulate in aquatic life (Forest Service 2004).

- Herbicides with high soil retention would be used in areas where there is potential to affect surface water or ground water resources.

- As needed to protect the efficacy of the herbicide, water would be buffered, depending on hardness, pH, and other factors.

Highly water-soluble herbicides would not be used in areas where there is potential to affect surface water or ground water resources.

- Herbicides with high volatility would not be used to treat areas located adjacent to sensitive areas because of the potential for unwanted movement of herbicides to these areas.

- In areas where there is the potential to affect surface water or ground water resources, herbicide pH and soil pH would be considered to select the herbicide with the lowest leaching potential.

Cultural Resources

- Surface disturbing activities, such as tilling or use of heavy equipment, would be avoided with the boundary of known or potential cultural resource or historic sites.

- Areas that may contain cultural resources and that have not been previously studies but may contain these resources would be surveyed or avoided. All surface disturbing activities such as digging, pulling, and tilling, would avoided in areas where cultural resources are identified or known to occur. In the event that cultural resources are encountered during manual or mechanical treatments, work would stop immediately and would not continue until the site can be evaluated and cleared by the staff archeologist.

- Consultation with resource managers during planning phase of exotic plant management projects is required to determine sensitive areas and acceptable levels of disturbance.

- Equipment used for re-vegetation and restoration projects will be evaluated and chosen that is determined to be the most effective to accomplish restoration goals while causing the least disturbance to cultural resources.

- Weed management personnel will be briefed about working in a protecting cultural resource sites.

- Vehicle traffic will be limited to roads to protect vulnerable cultural resources.

- To reduce impacts of park personnel on cultural resources, crews will follow field SOP's, such as stay on trails and work in small teams.

- Burn piles will not be constructed within 100 feet of known cultural resources.

- Should preservation and/or restoration activities result in unearthing previously undiscovered cultural resources, work would be stopped in the area of any discovery and the park would, consult with the state historic preservation officer and the Advisory Council on Historic Preservation, as necessary, according to §36 CFR 800.13, Post Review Discoveries. In the unlikely event that human remains are discovered during construction, provisions outlined in the Native American Graves Protection and Repatriation Act (1990) would be followed.

- The National Park Service would ensure that all workers are informed of the penalties for illegally collecting artifacts or intentionally damaging archeological sites and historic properties. Workers would also be instructed on procedures to follow in case a previously unknown archeological resource is uncovered during construction. Preservation and restoration workers and supervisors would be informed about the special sensitivity of the Historic Site's values and regulations

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Human Health and Safety

- Use of appropriate personal protective equipment PPE will be used when implementing control techniques.

All SOP's will be reviewed and followed prior to implementation.

- All herbicide labels will be followed to ensure that proper application is used in a safe manner.

- A Job Hazard Analysis for herbicide application will be reviewed prior to implementation.

- Signs will be posted to inform visitors of chemically treated areas. Chemically treated areas will be temporarily closed off to visitors. All federal, state, and local regulations regarding herbicide use would be followed at all times.

- All product labels would be read and followed by herbicide applicators. It is a violation of federal law to use an herbicide in a manner that is inconsistent with its label.

- Herbicide applicators would obtain any certifications or licenses required by the state and/or county.

- A construction zone for installation of the buried utility lines, as well as staging areas and work zones would be identified and demarcated with construction tape or some similar material prior to any preservation or restoration activities. The tape would define the zone and confine the activity to the minimum area needed for implementing the project. All protection measures would be clearly stated in the construction specifications, and workers would be instructed to avoid conducting activities beyond the zone as defined by the fencing. In addition, the National Park Service would ensure that all workers are informed that damage to resources outside the scope of work is subject to prosecution, fine, restitution costs, and other penalties.

Visitor Use and experience

- Preservation and restoration activities would be scheduled to minimize preservation and restoration impacts upon visitors.

- Areas not under construction would remain accessible to visitors as much as is safely possible.

- Park visitors would be informed via interpretive brochures of any on-going vegetation management or restoration activities.

- The efficacy of all mitigation measures would be monitored and adjusted if needed, using best management practices, adaptive management practices, and best available science.

Alternative Summaries

The objectives for this project are identified in the *Purpose and Need* chapter. The major components of the three alternatives carried forward are summarized in Table 1, along with comparison of the ability of these alternatives to meet the project objectives. Alternative 1 (No Action), does not meet the objectives for the project. Alternative 2 (Proactive Vegetation/Cultural Landscape Management) meets the objectives for the project and is the Preferred Alternative, and Alternative 3 (Limited Vegetation/Cultural Landscape Management) minimally meets the project objectives.

Table 1 – Summary of Alternatives and Extent to Which Each Alternative Meets Project Objectives.

Alternative Elements	Alternative 1 – No Action	Alternative 2 – Proactive Vegetation/Cultural Landscape Management	Alternative 3 – Limited Vegetation/Cultural Landscape Management
General Description	• Maintain current management actions within the Monument. • No treatment of non-native vegetation. • No active restoration of vegetation or the cultural landscape.	• Treatment of non-native vegetation using the entire tool box (mechanical, biological, cultural, prescribed fire, and chemical). • Active restoration of vegetation and the cultural landscape.	• Treatment of non-native vegetation using mechanical, biological, cultural, and prescribed fire tools. • Preservation of native vegetation. No active restoration of vegetation and the cultural landscape.
Uplands and Slopes	• Gas well operations, including road maintenance and gas well maintenance would continue • Archeological preservation and condition assessment would continue. • Maintenance by utility companies. • Monitoring and research would continue.	• Augment native species through replantings and seeding while minimizing soil intrusion. • Use irrigation water sparingly and short-term to establish transplants and seeds. • Actively restore more natural conditions to evoke Prehistoric Landscape: regrade pushpile and other recently created topographic features, regrade well pads and access roads, regrade and scarify, revegetate dirt roads (see reference map). Backfill potholes and other disturbed areas, remove above ground utilities, actively revegetate modern homesite (clean up remaining homesite remains, seeding and planting of area and road into site). • Treat non-native vegetation using mechanical (e.g., hand removal, limited bulldozer work, chainsaws, shovels), biological (insects), cultural (goats), prescribed fire and/or chemical tools. • Prioritize non-native management.	• Same as alternative 2 except treat non-native vegetation using non-chemical alternatives only. • Preserve and protect existing native vegetation. Allow native vegetation to revegetate naturally. • Do not remove or recontour recent features, such as pushpiles, well pad, gas line routes. No active vegetative restoration of modern homesite or dirt roads.

Alternative Elements	Alternative 1 – No Action	Alternative 2 – Proactive Vegetation/Cultural Landscape Management	Alternative 3 – Limited Vegetation/Cultural Landscape Management
		Noxious weed treatment is generally higher priority than other non-natives . • Conduct inventory and monitoring for early detection of new non-native species. • Monitor non-native treatments for efficacy. • Monitor to ensure no new social trails or erosion. Close and rehab new social trails when needed. • Well pad related activities and old homesites are restored consistent with above.	
Old Fields/Cultivated Lands	• Archeological preservation and condition assessment. • Maintenance by utility companies. • Lateral ditch maintenance. • No active restoration of historical structures or active restoration to revegetate. • Cattle grazing by adjacent property owner and run over irrigation by adjacent property owner.	• The area is not fully restored, but rather partially restored, to the natural landscape. Remove and/or recontour irrigation ditches where they impede surface water flow (even if irrigation system including ditches is found eligible.) No additional ground disturbance for irrigation of vegetation actions. Reclaim disturbed areas where homesites existed. Stimulate germination of native seed bank with the application of soil amendments. Use vegetative barriers to manage prairie dog colonies. • Seed and plant with native species. Use irrigation water sparingly and short-term to establish transplants and seeds. • Protect subsurface cultural materials. Consider depth of plow	• Same as alternative 2 except treat non-native vegetation using non-chemical alternatives only. • Plant shrubs predominately for prairie dog containment. Any revegetation would be on a smaller scale as compared to Alternative 2. Actively remove noxious weeds, but not all non-natives. • Features remaining from vernacular landscape historic agricultural activities such as tailwater pond, fencing, corrals, outhouse, lateral irrigation ditches, are left as is without active management unless there is a management conflict (such as for safety). • No active vegetative restoration of dirt roads. Remove old asphalt on Ruins Road but no active

Alternative Elements	Alternative 1 – No Action	Alternative 2 – Proactive Vegetation/Cultural Landscape Management	Alternative 3 – Limited Vegetation/Cultural Landscape Management
		zone and other factors. • Remove highly visible remains from historic vernacular landscape: fencing, outbuildings, corrals, and agricultural features. Recontour, regrade and scarify, revegetate dirt roads and old Ruins Road bed (see reference map for location of roads). • Backfill and/or revegetate eroding archeological sites as appropriate. • Remove overhead power lines and above ground utilities. • Treat non-native vegetation using mechanical (e.g., hand removal, limited bulldozer work, chainsaws, shovels), biological (insects), cultural (goats), prescribed fire and/or chemical tools. • Monitor non-native treatments for efficacy. • Prioritize non-native management. Noxious weed treatment is generally higher priority than other non-natives. • Elm trees are eliminated. • Inventory and monitoring for early detection for new non-native species. • Erect fencing as appropriate to restrict livestock grazing.	vegetative restoration.
Core Cultural Area	• Visitor use – mostly on existing trails. • Archeological preservation and condition assessment. • Fire management: fuels reduction	• Aggressive treatment on the ruin mounds. Revegetate steep slopes. All vegetation management activities would seek cooperative opportunities with	• Same as alternative 2 except treat non-native vegetation using non-chemical alternatives only. • Mechanical cuts are required to prevent resprouts in future years.

Alternative Elements	Alternative 1 – No Action	Alternative 2 – Proactive Vegetation/Cultural Landscape Management	Alternative 3 – Limited Vegetation/Cultural Landscape Management
	• Stock piles for preservation work (e.g., soil). • No road maintenance (passive restoration). • Restricted use of roads (some use for preservation work). • Removal of weeds from walls. • Berm ruin walls and add chips from fuels reduction. • Targeted application of herbicide for bindweed on walls.	park partners. • Stock piles for preservation work (e.g., soil). • Selectively remove shrubs on archeological resources. Reseed with native grasses. Use irrigation water sparingly and short-term to establish transplants and seeds. • Mechanically remove shrubs and brush from ruin walls and adjacent areas. Chemically treat stumps. Monitor in future years. • Remove tailwater drainage pipe and recontour site as appropriate. • Remove structures and activities or screen visual intrusions, such as plant trees to screen maintenance area from visitor trails. Maintain and replace as needed the existing cottonwood trees. Recontour, scarify, and reseed dirt road beds as appropriate (see Fig. 1). • Remove elm trees and treat stumps with chemicals to avoid resprouting • Prioritize non-native management. Noxious weed treatment is generally higher priority than other non-natives (this is detailed in Appendix B, Invasive Plant Management Plan). • Treat non-native vegetation using mechanical (e.g., hand removal, limited bulldozer work, chainsaws, shovels), biological (insects),	

Alternative Elements	Alternative 1 – No Action	Alternative 2 – Proactive Vegetation/Cultural Landscape Management	Alternative 3 – Limited Vegetation/Cultural Landscape Management
		cultural (goats), and/or chemical tools. Chemical and mechanical treatments to be sensitive to cultural resources. • Inventory and monitoring for early detection for new non-native species. • Monitor non-native treatments for efficacy.	
Riparian/Floodplain	• Maintenance by utility companies. • Trespassing for fishing. • Archeological preservation and condition assessment.	• Eradicate tamarisk and Russian olive using mechanical, biological, and chemical tools. All options must consider debris removal. • Monitor eradication efficacy quantitatively. • Actively plant native woody shrubs and herbaceous vegetation. Use irrigation water sparingly and short-term to establish transplants and seeds. • All options seek cooperative opportunities. Develop restoration demonstration area/ model/ program/ leadership and showcase efforts to others. Protect and maintain beneficial natural processes, such as flooding. • Remove features from vernacular landscape—building remains, fencing, outbuildings. • Treat non-native vegetation using mechanical (e.g., hand removal, limited bulldozer work, chainsaws, shovels), biological (insects), cultural (goats), prescribed fire	• Same as alternative 2 except treat non-native vegetation using non-chemical alternatives only. • Monitor eradication efficacy of vegetation activities qualitatively. No active planting of native woody shrubs and herbaceous vegetation. Monitor progress and intercede where appropriate with plantings. • Remove features from vernacular landscape only when they conflict with management objectives.

Alternative Elements	Alternative 1 – No Action	Alternative 2 – Proactive Vegetation/Cultural Landscape Management	Alternative 3 – Limited Vegetation/Cultural Landscape Management
		and/or chemical tools. • Prioritize non-native management. Noxious weed treatment is generally higher priority than other non-natives (would be detailed in Weed Management Action Plan). • Inventory and monitoring for early detection for new non-native species. • Monitor non-native treatments for efficacy.	
Farmers Ditch	• Targeted herbicide application for invasive weeds. • Maintenance of Farmers Ditch by ditch company.	• Work with partners (Ditch Company) to develop Best Management Practices. • Use irrigation water sparingly and short-term to establish transplants and seeds. • Treat non-native vegetation using mechanical (e.g., hand removal, limited bulldozer work, chainsaws, shovels), biological (insects), cultural (goats), prescribed fire and/or chemical tools. • Prioritize non-native management. Noxious weed treatment is generally higher priority than other non-natives. Would be detailed in Weed Management Action Plan. • Inventory and monitoring for early detection for new non-native species. • Monitor non-native treatments for efficacy.	• Same as alternative 2 except treat non-native vegetation using non-chemical alternatives only.
Historic District Landscape	• On-going maintenance of structures as needed. • Irrigation of vegetation at picnic	• Overall treatment is rehabilitation with partial historic restoration of this landscape.	• Same as alternative 2 except non-native species would be removed using non-chemical treatments

Alternative Elements	Alternative 1 – No Action	Alternative 2 – Proactive Vegetation/Cultural Landscape Management	Alternative 3 – Limited Vegetation/Cultural Landscape Management
	area. • City water on grass at Visitor Center. • Visitor use of lawns. • Maintenance of lawns (mowing, raking of native vegetation). • Maintenance of water lines. • Maintenance by utility companies. • Maintenance of asphalt.	• Aggressive removal of noncontributing non-native vegetation, such as Siberian elm. • Blue grass sod is removed and replaced with contributing native vegetation types. • Use irrigation water sparingly and short-term to establish transplants and seeds. • Vegetation impacts to archeological sites and Prehistoric landscape are minimized. • Declining cottonwoods are replaced with replantings of native cottonwoods as appropriate for Historic District landscape. Native cottonwoods in picnic area are replaced as needed. • Back patio: research and evaluate current plantings in back patio/courtyard to vegetation compatible with the historic landscape. Remove wild roses and vegetation adjacent to stucco walls as appropriate for historic landscape. Replace Siberian elms with cottonwoods as appropriate for historic landscape. • Continue cyclic maintenance of features—stucco walls and buildings, painting, parking lot paving, walkway and trail repair. • Preventative hazard tree and limb removal. • Establish native grasses in picnic area that do not require regular	

Alternative Elements	Alternative 1 – No Action	Alternative 2 – Proactive Vegetation/Cultural Landscape Management	Alternative 3 – Limited Vegetation/Cultural Landscape Management
		mowing. • Restore colors, textures and patterns of exterior stucco and paints wherever possible and appropriate where there is supporting historic documentation. • Treat non-native vegetation using mechanical (e.g., hand removal, limited bulldozer work, chainsaws, shovels), biological (insects), cultural (goats), and/or chemical tools. • Prioritize non-native management. Noxious weed treatment is generally higher priority than other non-natives (this is detailed in Appendix B, Invasive Plant Management Plan). • Inventory and monitoring for early detection for new non-native species. • Monitor non-native treatments for efficacy.	
Orchard and ornamental trees	• Maintain as is, no pruning of trees, water orchard west of West Ruin as needed, no water to riparian orchard. • No replacement of trees, allow orchard to decline.	• Remove orchard trees according to guidelines in the General Management Plan.	• Remove orchard trees according to guidelines in the General Management Plan.
Park Developed Areas (Exclusive of Historic District)	• Limited mowing of yard areas. • Limited watering of lawns. • Removal of hazard tree limbs.	• Overhead utility lines are relocated underground. • Visual intrusions are minimized through relocation or use of native vegetation screen. • Treat non-native vegetation using	• Same as alternative 2 except non-native species would be removed using non-chemical treatments.

Alternative Elements	Alternative 1 – No Action	Alternative 2 – Proactive Vegetation/Cultural Landscape Management	Alternative 3 – Limited Vegetation/Cultural Landscape Management
		mechanical (e.g., hand removal, limited bulldozer work, chainsaws, shovels), biological (insects), cultural (goats), prescribed fire and/or chemical tools. • Use irrigation water sparingly and short-term to establish native transplants and seeds. • Prioritize non-native management. Noxious weed treatment is generally higher priority than other non-natives (this is detailed in Appendix B, Invasive Plant Management Plan). • Inventory and monitoring for early detection for new non-native species. • Monitor non-native treatments for efficacy. • Restore native vegetation where appropriate. • Administrative trailer removed and surrounding area restored as appropriate. • Existing structures and buildings would be maintained compatible with historic landscape.	
Project Objectives	**Meets Project Objectives?**	**Meets Project Objectives?**	**Meets Project Objectives?**
Minimize past and future damage and prevent impairment to cultural resources from vegetation or lack thereof.	No	Yes	Moderate. Does not meet objectives for non-native vegetation that can only be successfully eradicated with chemical treatments. No active restoration of vegetation or cultural landscape.
Prevent the spread of non-	No	Yes	Moderate. Does not meet objectives

Alternative Elements	Alternative 1 – No Action	Alternative 2 – Proactive Vegetation/Cultural Landscape Management	Alternative 3 – Limited Vegetation/Cultural Landscape Management
native and/or invasive species and the introduction of new non-native species.			for non-native vegetation that can only be successfully eradicated with chemical treatments.
Improve the condition and integrity of the Ancient Aztec Community and Historic District landscapes where possible through vegetation management.	No	Yes	Moderate. Does not meet objectives for non-native vegetation that can only be successfully eradicated with chemical treatments. No active restoration of vegetation or cultural landscape.
Educate and involve Monument neighbors and the public to enhance understanding and support for a sustainable vegetation management program.	No	Yes	Yes
Protect, restore, rehabilitate, and revegetate to a self-sustaining (natural) native regime that is compatible with the Ancient Aztec Community landscape.	No	Yes	Moderate. Does not meet objectives for non-native vegetation that can only be successfully eradicated with chemical treatments. No active restoration of vegetation or cultural landscape.
Restore, rehabilitate, and revegetate agriculturally disturbed areas to a self-sustaining native regime.	No	Yes	No
Protect and enhance, when feasible and appropriate, areas within Aztec Ruins that are dominated by native species from additional impacts.	No	Yes	Moderate. Does not meet objectives for non-native vegetation that can only be successfully eradicated with chemical treatments. No active restoration of vegetation or cultural landscape.
Improve health and safety and reduce liability issues	No	Yes	Moderate. Does not meet objectives for non-native vegetation that can only

Alternative Elements	Alternative 1 – No Action	Alternative 2 – Proactive Vegetation/Cultural Landscape Management	Alternative 3 – Limited Vegetation/Cultural Landscape Management
through vegetation management.			be successfully eradicated with chemical treatments.
Define priorities for cultural landscape treatments.	No	Yes	Yes
Improve the condition and integrity of the Ancient Aztec Community and Historic District landscapes where possible.	No	Yes	Moderate. Does not meet objectives for non-native vegetation that can only be successfully eradicated with chemical treatments. No active restoration of vegetation or cultural landscape.
Pursue partnership opportunities as feasible to improve vegetation management within the Monument and across administrative boundaries.	No	Yes	Yes

The anticipated environmental impacts for each alternative are summarized in Table 2. Only those impact topics that have been carried forward for further analysis are included in this table. The *Environmental Consequences* chapter provides a more detailed explanation of these impacts.

Table 2 – Environmental Impact Summary by Alternative.

Impact Topic	Alternative 1 – No Action	Alternative 2 – Proactive Vegetation/ Cultural Landscape Management	Alternative 3 – Limited Vegetation/ Cultural Landscape Management
Vegetation	The overall impacts to vegetation for all vegetation zones would be direct, long-term, moderate to major, and adverse because this alternative does not restore areas with non-native vegetation to native vegetation or restore natural processes to regenerate native species.	The overall impacts to vegetation for all vegetation zones would be direct, long-term, moderate to major, and beneficial because this alternative focuses on preserving native species and restoring areas with non-native vegetation to native vegetation and restoring natural processes, such as flooding and fire, to regenerate native species.	The overall impacts to vegetation for all vegetation zones would be direct, long-term, minor, and beneficial because this alternative focuses on preserving native species but does not include active restoration. The impacts to vegetation for all vegetation zones would also be direct, long-term, minor to moderate, and adverse because this alternative does not use chemicals that are necessary to remove aggressive species, such as Russian olive and tamarisk, which compete and displace native species.
Cultural Landscapes	The overall impacts to the cultural landscape would be direct, long-term, minor, and beneficial because it provides generally positive benefits that maintain cultural landscapes in good condition. There are negligible impacts that are mitigated through documentation and monitoring.	Overall, there would be no adverse effects and the two eligible landscapes and ineligible landscape would have direct, long-term, minor and moderate, beneficial effects.	Overall, there would be no adverse effects and the two eligible landscapes and ineligible landscape would have direct, long-term, minor, beneficial effects.
Historic Structures	The no action alternative has no adverse effects, and provides generally beneficial eddects that maintain historic structures in good condition. There are minor impacts that are mitigated through documentation and monitoring.	Alternative 2 would have direct, long-term, minor, beneficial effect on historic structures in the Historic District. For prehistoric structures, Alternative 2 has no adverse effects and provides very beneficial effects that maintain historic structures in good condition. Possible impacts from mechanical plant removal would be mitigated through monitoring and implementation of techniques that cause little disturbance.	Alternative 3 has no adverse effects and provides very beneficial effects that maintain historic structures in good condition. Possible impacts from mechanical plant removal would be mitigated through monitoring and implementation of techniques that cause little disturbance.

Impact Topic	Alternative 1 – No Action	Alternative 2 – Proactive Vegetation/ Cultural Landscape Management	Alternative 3 – Limited Vegetation/ Cultural Landscape Management
Archeological Resources	Overall, there would be direct, long-term, negligible to minor, impacts due to continued erosion and cumulative effects. Current practices result in adequate archeological resource management, but cumulative effects would gradually impact archeological sites and sometimes result in destruction of more ephemeral archeological resources.	Alternative 2 would result in overall beneficial effects with no adverse effects. Short-term impacts from treatment procedures would be avoided through selection of minimally invasive procedures and mitigated through archeological monitoring and documentation.	Alternative 3 would result in overall in beneficial effects with no adverse effects. Short-term impacts from treatment procedures would be avoided through selection of minimally invasive procedures and mitigated through archeological monitoring and documentation.
Visitor Use and Experience	The presence of recent-historic landscape features, including orchards, would continue to distract and confuse visitor interest from the primary resource significances identified in the GMP, resulting in indirect, long-term, adverse effects, particularly in proximity to the West Ruin. The impact of outlying orchards on visitor experience would cumulatively increase from minor impacts during ranger-led activities to moderate adverse impacts if trails are built through, near, or overlooking them in the future. Non-native vegetation would continue to have an indirect, long-term, negligible, adverse impact.	Overall effects would be direct, long-term, minor, beneficial. In time, the cumulative benefit would override any short-term, negligible impacts caused by physical restoration techniques to native plant communities.	Overall effects would be direct, long-term, minor, and beneficial but less than Alternative 2 (Proactive Vegetation/Cultural Landscape Management). In time, the cumulative benefit would override any short-term, negligible impacts caused by physical restoration techniques to native plant communities.
Wildlife	If there is no shift in plant communities to an increased non-native component, there would be negligible impacts to wildlife species that currently exist in those communities. However, this alternative does not take advantage of opportunities to improve natural processes and conditions for native wildlife. Furthermore, if non-native plant establishment increases, impacts to native wildlife communities would be indirect, long-term, moderate, and adverse because this would decrease useable habitat and foraging opportunities.	The overall impacts to native wildlife would be direct and indirect, long-term, minor to moderate, and beneficial because this alternative focuses on restoration and preservation of native plant communities, which would increase useable habitat and promote diversity.	If there is no shift in plant communities, there would be a negligible impact to the wildlife species that currently exist in those communities. If non-native plant establishment increases, impacts to native wildlife communities would be indirect, long-term, moderate, and adverse because this would decrease useable habitat and foraging opportunities.

Impact Topic	Alternative 1 – No Action	Alternative 2 – Proactive Vegetation/ Cultural Landscape Management	Alternative 3 – Limited Vegetation/ Cultural Landscape Management
Special Status Species	This alternative does not take advantage of opportunities to improve natural processes and habitat conditions for species of concern within the Monument, nor does it take advantage of the opportunity to contribute to native habitat continuity and connectivity on a more regional basis. If non-native plant establishment increases, impacts to these species of concern would be indirect, long-term, moderate, and adverse because this would decrease useable habitat and foraging opportunities.	The overall impacts to species of concern would be direct and indirect, long-term, minor to moderate, and beneficial because this alternative focuses on restoration and preservation of native plant communities, which would increase useable habitat and habitat diversity for special status species/species of concern.	If there is no shift in plant communities, there would be a negligible impact to the special status species/species of concern species that currently exist in those communities. If non-native plant establishment increases, impacts to native wildlife communities, including special status species/species of concern, would be indirect, long-term, moderate, and adverse because this would decrease useable habitat and foraging opportunities.
Water Resources	The overall impacts to water quantity and quality would vary from little to no effect in the Aztec Ruins Historic District and Park Developed area to long-term minor in the uplands, slopes, and fields. In the riparian/floodplain, if no action results in an increasing tamarisk community, impacts to water quality could be direct, long-term, moderate, and adverse.	The overall impacts to water resources would be direct, long-term, minor to moderate, and beneficial because this alternative focuses on restoration and preservation of native plant communities, which would minimize soil erosion and improve surface flow and runoff of water.	In the uplands and slopes, the lack of planting and seeding for restoration of native plant community and not using chemicals to treat the non-native plants would result in direct, short-term and long-term, moderate, adverse impacts on water resources because it would not promote a native plant community, and it would not improve conditions for soil stability and water runoff. In the riparian/floodplain, the impacts to water quality could be direct, long-term, minor to moderate, and adverse depending on whether the tamarisk community.
Soil Resources	The overall impacts to soil for all vegetation zones would be direct, long-term, minor, and adverse due to erosion through natural processes and human disturbances.	The overall impacts to soil for all vegetation zones would be direct, long-term, minor to moderate, and beneficial, with moderate impacts occurring in vegetation zones that are more disturbed, such as the old fields/cultivated lands and riparian/floodplain, due to decreased soil erosion through the establishment of native vegetation and associated changes to soil chemistry.	The overall impacts to soil for all vegetation zones would be direct, long-term, minor, and beneficial due to decreased soil erosion through establishment of native vegetation and associated changes to soil chemistry. Impacts would not include moderate beneficial changes because not all non-native species would be controlled due to chemical treatments not being included in this alternative.
Riparian Zone/Floodplain	No action to restore the native plant community in the riparian zone would	The overall impacts to the riparian/floodplain would be direct, long-	It is expected that without chemical treatments, the abundance of Russian

Impact Topic	Alternative 1 – No Action	Alternative 2 – Proactive Vegetation/ Cultural Landscape Management	Alternative 3 – Limited Vegetation/ Cultural Landscape Management
	most likely result in continued increase of non-native plants and decrease of native plants, which could result in compromised proper functioning condition of the riparian zone and floodplain, resulting in direct, long-term, moderate, adverse impacts.	term, minor to moderate, and beneficial because this alternative focuses on restoration and preservation of native plant communities, which provide more natural ecological processes.	olive and tamarisk would increase, resulting in direct, long-term, moderate, adverse impacts to the riparian/floodplain.

Environmentally Preferable Alternative

According to the CEQ regulations implementing NEPA (43 CFR 46.30), the environmentally preferable alternative is the alternative "that causes the least damage to the biological and physical environment and best protects, preserves, and enhances historical, cultural, and natural resources. The environmentally preferable alternative is identified upon consideration and weighing by the Responsible Official of long-term environmental impacts against short-term impacts in evaluating what is the best protection of these resources. In some situations, such as when different alternatives impact different resources to different degrees, there may be more than one environmentally preferable alternative."

Alternative 2 (Proactive Vegetation/Cultural Landscape Management) is the environmentally preferable alternative for several reasons: (1) Minimize past and future damage and prevent impairment to cultural resources from vegetation or lack thereof; (2) Prevent the spread of non-native and/or invasive species and the introduction of new non-native species; (3) Improve the condition and integrity of the Ancient Aztec Community and Historic District landscapes where possible through vegetation management; (4) Educate and involve Monument neighbors and the public to enhance understanding and support for a sustainable vegetation management program; (5) Protect, restore, rehabilitate, and revegetate to a self-sustaining (natural) native regime that is compatible with the Ancient Aztec Community landscape; (6) Restore, rehabilitate, and revegetate agriculturally disturbed areas to a self-sustaining native regime; (7) Protect and enhance, when feasible and appropriate, areas within Aztec Ruins that are dominated by native species from additional impacts; (8) Improve health and safety and reduce liability issues through vegetation management; (9) Define priorities for cultural landscape treatments; (10) Improve the condition and integrity of the Ancient Aztec Community and Historic District landscapes where possible; (11) Pursue partnership opportunities as feasible to improve vegetation management within the Monument and across administrative boundaries.

By contrast, Alternative 1 (No Action) is not the environmentally preferable alternative because, it meets none of the project objectives and Alternative 3 (Limited Vegetation/Cultural Management) only moderately meets objectives 1,2,3,5,7,8,10 and does not meet objective 6 at all.

Preferred Alternative

No new information came forward from public scoping or consultation with other agencies to necessitate the development of any new alternatives, other than those described and evaluated in this document. Alternative 2 is the environmentally preferable alternative and better meets the project objectives; therefore, it is also considered the NPS preferred alternative. For the remainder of the document, Alternative 2 will be referred to as the preferred alternative.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter analyzes the potential environmental consequences, or impacts, that would occur as a result of implementing the proposed alternatives. Topics analyzed in this chapter include vegetation, cultural landscapes, historic structures, archeological resources, visitor use and experience, wildlife, special status species, water resources, soil resources, and riparian and floodplains. All remaining impact topics were dismissed, as discussed in the *Purpose and Need*.

Included in this chapter are descriptions of the affected environment for the resource topics carried forward. Direct, indirect, and cumulative effects, as well as impairment are analyzed for each of these topics. Potential impacts are described in terms of type, context, duration, and intensity. General definitions of these impact classifications are defined as follows, while more specific impact thresholds are given for each resource at the beginning of each resource section.

- ***Type*** describes the classification of the impact as either beneficial or adverse, direct or indirect:

  - Beneficial: A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.

  - Adverse: A change that moves the resource away from a desired condition or detracts from its appearance or condition.

  - Direct: An effect that is caused by an action and occurs in the same time and place.

  - Indirect: An effect that is caused by an action but is later in time or farther removed in distance, but is still reasonably foreseeable.

- ***Context*** describes the area or location in which the impact would occur. Are the effects site-specific, local, regional, or even broader?

- ***Duration*** describes the length of time an effect would occur, either short-term or long-term:

  - Short-term impacts generally last only during construction, and the resources resume their pre-construction conditions following construction.

  - Long-term impacts last beyond the construction period, and the resources may not resume their pre-construction conditions for a longer period of time following construction.

- ***Intensity*** describes the degree, level, or strength of an impact. For this analysis, intensity has been categorized into negligible, minor, moderate, and major. Because definitions of intensity vary by resource topic, intensity definitions are provided separately for each impact topic analyzed in this Environmental Assessment.

Cumulative Effects: The Council on Environmental Quality (CEQ) regulations, which implement the National Environmental Policy Act of 1969 (42 USC 4321 et seq.), require assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts are considered for all three alternatives.

Cumulative impacts were determined by combining the impacts of the alternatives. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects at Aztec Ruins National Monument and, if applicable, the surrounding region. The geographic scope for this analysis includes elements within the Monument's boundaries, the view shed from the Monument's boundaries, and the Animas River from Durango, Colorado through the Monument, while the temporal scope includes projects within a range of approximately ten years. Given this, the following projects were identified for the purpose of conducting the cumulative effects analysis:

Past Actions Past actions include (1) gas well operations, including road maintenance and operations upgrades, (2) preservation actions on archeological sites, including stabilization and backfilling, (3) removal of structures, including homes, outbuildings, and fencing; previous cattle grazing, plowing, and irrigation of agricultural lands, (4) vegetation clearing and grading of lands north of Monument boundaries for housing development, (5) housing development adjacent to Monument boundaries, (6) relocation of Ruins Road, (7) withdrawal of water from previously irrigated fields and tailwater pond, (8) routine maintenance of historic features, such as the visitor center and parking lot walls, (9) restoration of historic irrigation ditch north of visitor center, (10) vegetation fuels reduction in East Ruin, (11) removal of boneyard between East and West Ruins, (12) establishment of preservation work area in maintenance area, (13) addition of hazardous storage building in maintenance area, and (14) construction and maintenance of Farmers Ditch.

Current Actions Current actions include (1) routine grounds and historical structure maintenance, (2) preservation work on ruins, including stabilization and backfilling, (3) maintenance of Farmers Ditch by the ditch company, (4) visitor use on existing trails, (5) irrigation use from Farmers Ditch (orchards and picnic area), (6) maintenance of Farmers Ditch laterals (NPS and downstream users), (7) emergency herbicide application along Farmers Ditch, herbicide on target species near ruin walls, and limited insecticide use on target species (harvester ants and stinging flying insects), (8) limited visitor use of closed areas, (9) gas well operations, including road maintenance and gas well maintenance, (10) fire fuels mitigation, (11) manual clearance of target invasive vegetation, (12) mowing near housing areas, (13) tree limb removal, (14) cattle grazing by adjacent landowner and run-over irrigation by adjacent landowner, (15) trespassing for access to the Animas River, (16) maintenance of electric, telephone, water, and sewage lines by utility companies, and (17) monitoring and research.

Future Actions Future actions may include (1) interpretive trail to East ruin, (2) interpretive trail to north mesa, (3) modification of Aztec Ruins Trading Post for office space, (4) possible drilling of natural gas wells on Monument property or exterior to the Monument but within sight of Monument property, (5) non-natives reductions, especially of Russian olive, tamarisk, Russian knapweed (*Acroptilon repens*), from along Farmers Ditch upstream from the Monument, (6) irrigation system changes, such as use of pipes rather than open ditches and lining the ditch, (7) reclamation of three existing well pads and access roads, (8) hiking/biking trail from the town of Aztec, (9) restoration of the old agricultural fields, and (10) restoration/removal of the orchards.

Vegetation

Affected Environment

Aztec Ruins National Monument lies within the Upper Sonoran life zone. Almost 300 plant species have been documented in the Monument, many of which are non-native (Rink and Cully 2007). Common native species in the Monument include big sagebrush (*Artemisia tridentata*), rabbitbrush *(Chrysothamnus nauseosus),* yucca (*Yucca* spp.), Utah juniper (*Juniper osteosperma)*, piñon pine (*Pinus edulis*), and a variety of grasses, such as blue grama (*Bouteloua gracilis*), James galleta (*Pleuraphis jamesii*), buffalograss (*Buchloe dactyloides*), alkali sacaton (*Sporobolus airoides*), and Indian ricegrass (*Achnatherum hyminoides* USDI 2005). Riparian vegetation includes cottonwoods (*Populus fremontii*), willows (*Salix exigua* and *S. goodiingii*), box elder (*Acer negundo)*, non-native Russian olive (*Elaeagnus angustifolia*), and non-native tamarisk (*Tamarix chinensis*).

As the topography rises away from the river, lands historically irrigated for pasture and fruit trees surround the Core Cultural Area that preserves most of the large prehistoric structures. Since acquiring these previously cultivated lands in the late 1990s, the Monument has discontinued irrigation according to a long-range plan of converting them to Upper Sonoran desert scrub native vegetation (USDI 2005). In 1892, irrigators constructed the Farmers Ditch, a major irrigation ditch running east to west through the Monument that supports a narrow band of native and non-native riparian vegetation. On the higher north terrace, native galleta and alkali sacaton grasses dominate. Broom snakeweed (*Gutierrezia sarothae*) also dominates the mesa slopes, providing evidence of historic degradation due to grazing and fire suppression. Less frequent native species include Indian ricegrass, prairie three-awn (*Aristida purpurea*), big sagebrush, four winged saltbrush (*Atriplex caescens)*, and prickly pear cactus (*Opuntia phaeacantha, O. polyacantha*). Gullies within the Uplands/Slopes management unit have the highest diversity of native vegetation within the Monument (Rink and Cully 2007). The nearly endemic Clover's fishhook cactus (*Sclerocactus cloveriae cloveriae*) is located in the Uplands/Slopes management unit (Rink and Cully 2007).

Historic use of Monument land for agricultural and grazing purposes has greatly contributed to introduction and establishment of numerous non-native plant species. In addition, an existing trailer park, a subdivision south of the Monument, a new subdivision being developed north and west of the

Monument, and gas wells are all potential vectors for introduction and establishment of non-native plant species within Monument boundaries. Total non-native plant cover in Aztec Ruins National Monument was approximately 27% in a 2008 non-native plant species inventory (Korb 2008). Common kochia (*Kochia scoparia*) had the highest overall plant cover for the entire Monument averaging 7.4%. Five other non-native species had an average plant cover greater than one percent for the entire Monument in the 2008 non-native plant species inventory: smooth brome (*Bromus inermis*) at 4.3%, Russian olive at 3.5%, Russian thistle (*Salsola tragus*) at 3.5%, intermediate wheatgrass (*Thinopyrum intermedium*) at 2.1%, and musk thistle (*Carduus nutans*) at 1.1% (Korb 2008). The Riparian/Floodplain management unit had the highest average non-native plant cover with 76.7% (Korb 2008). Russian olive had 31.2% average cover followed by smooth brome with 18.9%, musk thistle with 6.8%, meadow foxtail (*Alopecurus pratensis)* with 6.2%, and Canada thistle (*Circium arvense*) with 5%. The Old Fields/Cultivated Lands management unit had the second highest average non-native plant cover with 40.1% (Korb 2008). Common kochia had 17.8% average cover followed by prickly Russian thistle with 6.4%, intermediate wheatgrass with 5.3%, smooth brome with 4.6%, and Siberian elm (*Ulmus pumila*) with 1.7%. The Orchards management unit had the third highest average non-native plant cover with 34.2% (Korb 2008). Smooth brome had 22.5% average cover followed by meadow foxtail with 3.7%, timothy grass (*Phleum pretense*) with 3.7%, orchardgrass (*Dactylis glomerata*) with 1.2% and common kochia with 1.2%. The Farmers Ditch management unit had the fourth highest average non-native plant cover with 27.6% (Korb 2008). Common kochia had 12.9% average cover followed by prickly Russian thistle with 11.1%, tumble mustard (*Sisymbrium altissimum*) with 1.2%, cheatgrass (*Bromus tectorum*) with 1.2%, and Russian olive with 1.1%. The Core Cultural Area management unit had the fifth highest average non-native plant cover with 5.2% (Korb 2008). Common kochia and cheatgrass both had 2.5% average cover and the four other species each having less than 0.1% average cover. The Uplands/Slopes management unit had the lowest average non-native plant cover with 2.8% (Korb 2008). Filaree (*Erodium cicutarium*) had 1.3% average cover, and cheatgrass had 1.1%. The other eight species in the Uplands/Slopes management unit had less than one percent cover.

There were 57 non-native species within the approximately 112 ha (277 ac) total area sampled in the 2008 non-native plant inventory (Korb 2008). The highest number of non-native plant species was in the Old Fields/Cultivated Lands management unit (51), followed by the Farmers Ditch (34), Orchards (33), Riparian/Floodplain (33), Core Cultural Area (22), and Uplands/Slopes (20) management units (Korb 2008).

The New Mexico Department of Agriculture has listed 20 species as noxious weeds for control and eradication in accordance with the Noxious Weed Management Act of 1998 (Office of the Director/Secretary 1998). Government officials have divided New Mexico's noxious weed list into three categories of non-native species to New Mexico. Class A species have the highest priority because they currently are not found or are limited in distribution in New Mexico. Class B species are species limited to portions of the state and infestations should be contained to prevent further spread. Class C species are widespread in New Mexico and treatment for these species is to be decided by land managers at the local level based on control feasibility and degree of infestation. There are four Class A noxious species in the Monument: hoary cress (*Cardaria draba*), Canada thistle, perennial pepperweed (*Lepidium latifolium*), and Scotch thistle (*Onopordum acanthium*, Korb 2008). There are two species in the Monument that are listed as Class B non-native species in New Mexico: musk thistle and Russian knapweed (Korb 2008). All five Class C non-native species listed by the New Mexico Department of Agriculture are present in the Monument: bindweed (*Convolvulus arvensis),* tamarisk (*Tamarix* spp.), Russian olive, jointed goatgrass (*Aegilops cylindrical*), and Siberian elm.

Intensity Level Definitions

One of the purposes of this plan is to return the monument's vegetation to a self-sustaining regime, therefore this analysis is only focused on native vegetation. To analyze the impacts on vegetation resources, the Monument used research, scientific literature, vegetation surveys (See web inks section in references), other Monument plans, professional judgments and monument staff insights, public input,

and consultation with other permitting agencies. Vegetation may be threatened by physical soil disturbance, physical removal, or invasive species. According to the National Park Service's Management Policies (2006), the National Park Service would strive to preserve fundamental physical and biological processes, as well as individual species, features, and plant and animal communities. The Service would try to maintain all the components and processes of naturally evolving park ecosystems, including the natural abundance, diversity, and genetic and ecological integrity of the plant species native to those ecosystems. Just as all components of a natural system would be recognized as important, natural change would also be recognized as an integral part of the functioning of natural systems. For the purposes of analyzing potential impacts, the intensity thresholds are as follows:

Negligible: Impacts would have no measurable or perceptible changes in the plant community composition, abundance, distribution, or ecological integrity.

Minor: Impacts would be measurable or perceptible but would be localized within a relatively small area. The overall viability of the plant community would not be affected and, if left alone, would recover.

Moderate: Impacts would cause a change in the plant community composition, abundance, distribution, or ecological integrity; however, the impact would remain localized.

Major: Impacts to the plant community would be substantial, highly noticeable, and permanent.

Impacts of Alternative 1 – No Action

Zones that have been less impacted by natural and human disturbance, such as the uplands and slopes vegetation, would have long-term, minor, adverse effects because of the current low abundance of non-native species. The abundance of non-natives would remain low if natural and human disturbances remain low in the future. If any unanticipated natural disturbance occurs, there is a potential of existing and new invasive weeds to become established and the ability to undertake appropriate restorative activities may be limited.

Vegetation zones with higher disturbance, such as old fields and cultivated lands, and areas with higher non-native species abundance, such as riparian areas with tamarisk and Russian olive, would have a more noticeable change with no active restoration (moderate adverse) because non-native abundance would continue to increase and out compete native species (Carman and Brotherson 1982, Howe and Knoff 1991, Sheely et al. 1999). Effects would be direct, long-term, moderate, and adverse. Effects of targeted herbicide application for invasive weeds near the Farmers Ditch would be direct, long-term, moderate, and beneficial. Well pads, dirt roads, irrigation ditches, homesites and the developed area that are not actively restored to evoke the Ancient Aztec Landscape would have direct, long-term, moderate, adverse impacts because these disturbed areas would serve as vectors for non-native plants to get established in adjacent vegetation zones (Allen and Hansen 1999, Sheely and Petroff 1999, van der Wal et al. 2008).

The maintenance of blue sod grass in the core cultural area and in the picnic area would have direct, long-term, moderate, adverse, impacts because of irrigation needs and the continued presence of non-native grasses. Orchards would remain as a horticultural crop, and continued irrigation of pear and apple orchards would support riparian species, such as cattails (*Typha* spp.), that would not otherwise be supported. Cattle grazing in old fields and cultivated lands would be direct, short-term, moderate, and adverse due to the removal of vegetation, physical soil disturbance to allow non-native vegetation expansion, and non-native seed dispersal (Renne and Tracy 2007). Prairie dogs (*Cynomys gunnisoni*) would continue to have a direct, long-term minor impact by consuming both native (adverse) and non-native (beneficial) vegetation (Davidson and Lightfoot 2008).

Prescribed fire would have varying impacts, minor to moderate, beneficial or adverse, on native and non-native vegetation depending on the individual species, fire season (spring, summer, fall) and fire intensity (minor to moderate, beneficial or adverse, (Brooks and Pyke 2001, Keeley 2006). Non-native species, such as Russian knapweed, can increase with fire (Leieune and Seastedt 2001) while other species, such as smooth brome, can decrease tillering during fall burns (Wilson and Stubbendieck 1997). Mitigation efforts to minimize adverse effects include burning within the historical range of variability for specific vegetation types and species and burning small areas of target species (Keeley 2006).

Aggressive treatments of all vegetation on the ruin mounds to achieve fuels reduction and preservation of the ruins walls would have direct, long-term, minor, adverse impacts. Targeted application of herbicide for bindweed on walls would have direct, long-term, minor, beneficial impacts. Without herbicide use in fuels reductions areas, where greasewood and Russian olive have been cut, rejuvenation of the plants would be ongoing, requiring repeated mechanical removal (Caplan 2002). Russian olive would return more vigorously without such treatments (Carman and Brotherson 1982).

Treatments, such as protecting subsurface cultural materials, removing and continued maintenance of stucco walls and buildings, painting, and parking lot paving, would have no impact on vegetation.

Cumulative impacts: Non-native species have the potential to spread to adjacent property owners, as well as throughout the Monument, having direct, long-term, moderate, adverse impacts, resulting in continued loss of native vegetation.

Conclusion: The overall impacts to vegetation for all vegetation zones would be direct, long-term, minor to moderate, and adverse because this alternative does not restore areas with non-native vegetation to native vegetation or restore natural processes to regenerate native species. This alternative would also provide for further invasive weed spread or establishment of new non-native species in the situation of unexpected ground disturbance due to human or natural causes.

Impacts of Alternative 2 – Proactive Vegetation/Cultural Landscape Management

Zones that have been less impacted by natural and human disturbance, such as the uplands and slopes vegetation, would have less noticeable change (minor, beneficial) from augmenting native species through replanting and seeding than areas with higher disturbance.

Vegetation zones with higher disturbance, such as the Farmers Ditch and old fields and cultivated lands and areas with higher non-native species abundance, such as riparian areas with tamarisk and Russian olive, would have a more noticeable change (moderate, beneficial) (Potthoff et al. 2005, Willms et al. 2005, Sheley et al. 2006, Lulow et al. 2007, Rein et al. 2007). In addition, areas, such as well pads, dirt roads, irrigation ditches, and homesites, actively restored to evoke a natural landscape that benefits not only the ecology and diversity of the area, but also provides the visitor with a better understanding and comprehension of the natural environment that surrounded the inhabitants of the ruins and the reason why the ruins were located where they were would have direct, long-term, moderate, beneficial impacts (Montalvo et al. 2002, Elseroad et al. 2003, Cole 2007).

Removal of blue sod grass in the core cultural area and the seeding of native grasses in the picnic area would also have direct, long-term, moderate, beneficial impacts. Fencing to restrict livestock grazing would have direct, long-term, minor, beneficial impacts. The beneficial impacts would be minor because of the small area of the Monument that would be fenced.

This alternative would use all possible tools to treat non-native vegetation including mechanical, biological (to include goat or appropriate animal use), chemical, cultural, and/or fire. Some chemicals would have an indirect, short-term minor adverse impact on native vegetation (Olszyk et al. 2008). Mitigation efforts include selecting chemicals for target species to reduce effects on native vegetation and to time treatments when native plants are less susceptible to adverse effects (dormant or not flowering).

Some biological treatments, such as goats, would have an indirect, short-term minor adverse impact on native vegetation. Mitigation efforts include intense grazing by goats of target species in specific locations for short durations and grazing when native plants are less susceptible to adverse effects (dormant or not flowering, Popay and Field 1996).

Prescribed fire would have varying impacts, minor to moderate, beneficial or adverse, on native and non-native vegetation depending on the individual species, fire season (spring, summer, fall), and fire intensity (minor to moderate, beneficial or adverse). Non-native species, such as Russian knapweed (Leieune and Seastedt 2001), while other species, such as smooth brome, can decrease tillering during fall burns (Wilson and Stubbendieck. 1997). Mitigation efforts to minimize adverse effects include burning within the historical range of variability for specific vegetation types and species and burning small areas of target species, (Keeley 2006). Prescribed fire is also used to stimulate non-native species germination (especially for non-native annuals), resulting in a depletion or minimization of the non-native species in the soil seedbank and to more effectively control a weed species by maximizing germination and making use of secondary treatment (mechanical, chemical, biological) more effectively.

Stimulating germination of the seed bank may have direct, short-term, minor, adverse impacts if the seed bank is composed of primarily non-native species (Iverson and Wali 1982, Roovers et al. 2006).

Physical soil disturbance from removing the tailwater drainage pipe in the core cultural area and relocating overhead utilities underground would have direct, short-term, minor, adverse impacts because it would remove existing native vegetation and cause soil disturbance that is more prone to non-native vegetation establishment (Hulbert 1955, Elmarsdottir et al. 2003). Any potential weed establishment as a result of ground disturbance activities would be mitigated by the planting of native species and the monitoring and treatment of any non-native species that may become established.

Aggressive treatments of all vegetation on the ruin mounds to achieve fuels reduction and preservation of the ruins walls would have direct, long-term, minor, adverse impacts.

Prioritizing non-native species management, inventorying and monitoring new non-native species, and monitoring non-native treatments for efficacy would have indirect, long-term, moderate, beneficial impacts because it would allow for the most aggressive species, noxious weeds, to have higher priority than other non-native species, would allow new non-native occurrences to be treated immediately, and would allow for treatments of non-native species to be assessed for effectiveness (Pimentel et al. 2000, Cox and Anderson 2004, Pimentel et al. 2004, Firn et al. 2008). The absence of quantitative monitoring would have a moderate, long term impact.

Treatments, such as protecting subsurface cultural materials, removing overhead power lines and above ground utilities, and continued maintenance of stucco walls and buildings, painting, and parking lot paving, would have no impact on vegetation.

Cumulative impacts: Active native vegetation restoration and reduction of non-native species would decrease the spread of non-native species to adjacent property owners and within the monument in areas encountering soil disturbance from well pad construction, relocation of aboveground utilities and irrigation systems, and others having direct, long-term, minor to moderate, benefits. Lack of active restoration activities (e.g. well pads, agricultural areas) would promote the expansion of non-native, invasive weeds species within the park. The absence of quantitative monitoring would have moderate, long term, adverse effects.

Conclusion: The overall impacts to vegetation for all vegetation zones would be direct, long-term, minor to moderate, and beneficial because this alternative focuses on preserving native species and restoring areas with non-native vegetation to native vegetation and restoring natural processes, such as flooding and fire, to regenerate native species.

Impacts of Alternative 3 – Limited Vegetation/Cultural Landscape Management

Overall, impacts would be similar to Alternative 2 (Proactive Vegetation/Cultural Landscape Management). However, there would be direct, long-term, moderate, adverse impact to the native plant community and Monument resources by not chemically treating some non-native species, such as Russian olive and tamarisk, which are most effectively removed using chemicals (Chavez 1996, Caplan 2002). The lack of active vegetation restoration of well pads, roads, and homesites and the developed area would have indirect, long-term, moderate, adverse impacts because of the continued presence of non-native species associated with these features and the expectation that non-natives would increase in abundance in these areas due to a lack of competition from natives and that non-natives may encroach into adjacent native vegetation (Guo 2007, Firn et al. 2008). The absence of quantitative monitoring of vegetation activities would result in direct and indirect, long-term, minor, adverse impacts on the ability to control and assess non-native vegetation treatments (Pimentel et al. 2004). There would be indirect, long-term, minor, adverse impacts for no active planting or seeding of native vegetation accept where appropriate and direct, long-term, minor, beneficial impacts for maintaining the integrity of vegetation without restoration (Cole 2007).

Cumulative impacts: The cumulative impacts will be the same as in Alternative 2 Non-native species that need chemical treatments for their removal would have the potential to spread to adjacent property owners and throughout the Monument, having direct, long-term moderate adverse impacts.

Conclusion: The overall impacts to vegetation for all vegetation zones would be direct, long-term, minor, and beneficial because this alternative focuses on preserving native species but does not include active restoration. The impacts to vegetation for all vegetation zones would also be direct, long-term, minor to moderate, and adverse because this alternative does not use chemicals that are necessary to remove aggressive species, such as Russian olive and tamarisk, which compete and displace native species.

Cultural Resources

Intensity Level Definitions

To analyze the impacts on cultural resources (cultural landscapes, historical structures, and archeology), the Monument used research, scientific literature, cultural resource surveys, other park plans, professional judgments and monument staff insights, public input, and consultation with other permitting agencies. According to the *National Park Service's Management Policies, 2006*, the National Park Service would employ the most effective concepts, techniques, and equipment to protect cultural resources against deterioration, environmental impacts, and other threats, without compromising the integrity of the resources. The treatment of a cultural landscape would preserve significant physical attributes, biotic systems, and uses when those uses contribute to historical significance. Treatment decisions would be based on a cultural landscape's historical significance over time, existing conditions, and use. Treatment decisions would consider both the natural and built characteristics and features of a landscape, the dynamics inherent in natural processes and continued use, and the concerns of traditionally associated peoples. The treatment implemented would be based on sound preservation practices to enable long-term preservation of a resource's historic features, qualities, and materials. The treatment of historic and prehistoric structures would be based on sound preservation practice to enable the long-term preservation of a structure's historic features, materials, and qualities. Archeological resources would be managed *in situ*, unless removal of artifacts or physical disturbance is justified by research, consultation, preservation, protection, or interpretive requirements. For the purposes of analyzing potential impacts, the intensity thresholds are as follows:

Negligible: Impact(s) is at the lowest levels of detection; barely measureable with hardly any perceptible consequences either adverse or beneficial.

Minor: Impact is detectable and measurable. If adverse, the impact would not diminish the overall integrity or significance of the resource and the National Register eligibility of the resource would be unaffected.

Moderate: Impact is readily apparent and considerable measureable. If adverse, the impact would result in some integrity or the significance of the resource and or the impact would change one or more of the character defining features of the resource, but would not affect the National Register eligibility of the resource.

Major: Impact is highly noticeable and substantial. If adverse the impact would result in the loss of integrity or significance of the resource and/or would change one or more of the character defining features to the extent that it would no longer be eligible for listing in the National Register of Historic Places.

CULTURAL LANDSCAPES

Affected Environment

There are two cultural landscapes, the Ancient Aztec Landscape and the Aztec Historic District Landscape, identified at Aztec Ruins National Monument that have been determined to be eligible for the National Register of Historic Places. The Ancient Aztec Landscape includes all lands within the current authorized boundary of Aztec Ruins National Monument. Because natural landforms apparently played an important role in the layout and use of the Ancient Aztec Landscape, the true limits of this landscape extend beyond the authorized boundaries of the Monument.

The monument was listed on the National Register in 1966, and the Aztec Ruins Historic District Landscape is a significant part of the monument's integrity. The Aztec Ruins Historic District Landscape has historical significance at the state level for its association with American government, recreation and culture, with a period of significance from 1931 to 1939. The Historic District Landscape contains examples of work accomplished by crews mobilized by a forward thinking president to move our country through the Depression of the 1930s. The landscape also has significance for its association with 20th century American culture because it was the home and work site of a dedicated and honored American archeologist, Earl Morris. The second period of significance is 1919-1952. Morris constructed a home at the site in 1919.

The history of changes to the site’s landscape suggests the history of American archeology and changes in philosophical approaches from the early days of archeology and NPS involvement to the present. The landscape was designed and developed as a New Deal project and, as such, included use of native plant materials and local building traditions, primarily adobe and stucco. Some adobe walls still exist in the building, as do cobble, cement, and stucco walls around the Visitor Center.

This impact topic has been retained because there are greater than minor impacts from non-native plant removal using mechanical, biological, cultural, chemical, and prescribed fire tools and greater than minor impacts due to actions to preserve and restore native plant species and the cultural landscape.

The third cultural landscape, the Historic Vernacular Landscape was determined to be ineligible due to lack of integrity and because none of the subject features were contributing based on integrity (NPS 2005). The Historic Vernacular period for the landscape ranges from the 1890s when the land was initially patented for agricultural use into the 1930s with Henry Abram’s operation (USDI 2006).

This impact topic will not be carried forward for discussion.

Impacts of Alternative 1 – No Action

The continued manual removal of weeds from ruin walls will have long-term, minor, and beneficial impacts, but the continued presence of non-native plants including elm within the Ancient Aztec Landscape is incompatible with the landscape and would have a direct, long-term, minor, adverse impact. The orchard is outside but within view of the Ancient Aztec Landscape, its continued presence would also have a direct, long-term, minor, adverse impact.

Modern intrusions into the Ancient Aztec Landscape such as overhead utility lines and park buildings would have a direct, long-term, minor, adverse impact. Fuels reduction would have a short-term, minor, adverse effect while the activity is being carried on, but would result in a long-term, minor to moderate, beneficial impact overall.

Greater water use than alternatives 2 and 3, by irrigating the orchard, picnic area, and visitor center lawn, would have direct and indirect, long-term, moderate, adverse impacts for the Aztec Ruins Historic District. Without treatment of non-natives and restoration of the native habitat, the presence of non-native plants will continue the loss of integrity to this landscape and result in direct, long-term, minor to moderate, adverse impact. Fuels reduction in the Aztec Historic District would have a short-term, minor, adverse effect while the activity is being carried on, but would result in a long-term, minor to moderate, beneficial impact overall.

Within the Historic District continued utility company maintenance will result in direct, long-term, minor adverse impact. The park would continue to maintain the adobe walls and asphalt which would have direct, long-term, minor beneficial impact.

Cumulative Impacts: Cultural landscapes would be maintained in their current condition. Over time, the incremental introduction of modern materials into both historic and Ancient Aztec Landscape would adversely affect historic integrity, but this effect is minor and necessary to maintain them in good condition. Documentation and monitoring of such maintenance provides mitigation of these adverse effects.

Conclusion: The overall impacts to the cultural landscape would be direct, long-term, minor, and adverse. Although, current preservation activity that maintain cultural landscapes in good condition are generally beneficial. There are negligible impacts that are mitigated through documentation and monitoring.

Impacts of Alternative 2 – Proactive Vegetation/Cultural Landscape Management

Partial restoration in the Aztec Ruins Historic District would enhance historic and ecological integrity and would have direct, long-term, minor, beneficial impact. Rehabilitation with partial historic restoration of the landscape and aggressive removal of noncontributing non-native vegetation, such as Siberian elm. Replacement of wild roses and vegetation adjacent to stucco walls compatible with the historic landscape would have direct, long-term, moderate, beneficial effects because the integrity of the landscape would be improved.

In the picnic area, removal of bluegrass sod and establishment of native grasses that do not require regular mowing would have direct, long-term, moderate, beneficial effects. Replacement of declining cottonwoods with replanting of native cottonwoods would have direct, long-term, moderate, beneficial effects Augmentation of native species through replanting and seeds, while minimizing soil disturbance, would have short term, minor, adverse impacts to soil, but would have direct, long-term, minor, beneficial impacts. Using mechanical, biological, cultural and/or chemical tools would have direct, long-term, minor, beneficial impacts.

Continued cyclic maintenance of stucco walls and buildings, painting, parking lot paving, walkway, and trail repair would have direct, long-term, minor, beneficial effects. Restoration of colors, textures and patterns of exterior stucco and paints wherever possible and appropriate, where there is supporting historic documentation, would have direct, long-term, moderate, beneficial effects because structural exteriors are highly visible to visitors**.** Removal and/or recontouring of irrigation ditches where they impede surface water flow, even if irrigation system including ditches is found eligible, would have direct, long-term, minor, adverse effects because several lateral ditches contribute to the overall eligibility of the Farmers Ditch and irrigation system and their removal would make them less visible and unusable.

Partial historic and ecological restoration, less watering, and rehabilitation of social trails, would have an overall direct, long-term, minor, beneficial impact on the Ancient Aztec Landscape. Restoration to conditions that evoke the ecology and history of the Ancient Aztec Landscape would have direct, long-term, moderate, beneficial impacts. Such actions include, but are not limited to, regrading pushpiles and other recently created topographic features, regrading well pads and access roads, removing administrative trailer, revegetating dirt roads, backfilling potholes and other disturbed areas, removing aboveground utilities, and actively revegetating the modern homesite (clean up remaining homesite remains, seeding and planting of area and road into site).

Augmentation of native species through replanting and seeds, while minimizing soil disturbance, would have short term, minor, adverse impacts to soil, but would have direct, long-term, minor, beneficial impacts. Using mechanical, biological, cultural and/or chemical tools would have direct, short-term, minor, adverse impacts. Monitoring to ensure no new social trails or erosion and closing new social trails would have indirect, short-term, minor, beneficial effects.

Aggressive treatment on the ruin mounds and revegetation of steep slopes with native grasses along with mechanical treatments of shrubs from ruin walls would have direct, short-term, moderate, beneficial effects because it would help control erosion of the ruins and preserve archeological resources. Screening visual intrusions, such as the maintenance area from visitor trails with trees, maintaining and replacing existing cottonwood trees, removing elm trees, removing the tailwater drainage pipe and recontouring site and scarifying and reseeding dirt road beds as appropriate in the core cultural area, would have direct, short-term and long-term, moderate, beneficial effects.

Cumulative Impacts**:** The historic and ecological integrity of the two eligible landscapes (Aztec Ruins Historic District and Ancient Aztec Landscape) would be enhanced, and removal of noncontributing Historic Vernacular Landscape features would help clarify the interpretation of the Ancient Aztec Landscape.

Conclusion**:** Overall, there would be no adverse effects and the two eligible landscapes would have direct, long-term, minor and moderate, beneficial effects with the restoration of the natural environment, including revegetation and the removal of non-native vegetation.

Impacts of Alternative 3 – Limited Vegetation/Cultural Landscape Management

Impacts would be similar to Alternative 2 (Proactive Vegetation/Cultural Landscape Management) for the Aztec Ruins Historic District except incompatible, non-native vegetation would be maintained rather than restored resulting in direct, long-term, moderate, adverse effects. Also, there would be direct, long-term, minor, adverse effects because the potential to reduce non-native species is lowered because no chemicals would be used in non-native species eradication treatments.

For the Historic Vernacular Landscape, impacts would be similar to Alternative 2 (Proactive Vegetation/Cultural Landscape Management) except revegetation would be on a smaller scale. Actively removing noxious weeds but not all non-native plants would have direct, short-term, minor, beneficial impacts because it would achieve the landscape evocative of the Ancient Aztec Landscape much more slowly. Planting shrubs and removing noxious weeds would have no adverse effect on the Historical Designed Landscape because the field areas are no longer present. Planting native shrubs predominately for prairie dog containment would have direct, long-term, minor, beneficial impacts.

Removing the agricultural fields is an adverse effect on the Historical Vernacular Landscape and adding non-agricultural vegetation and removing non-natives would continue to be an adverse effect but does not constitute an adverse effect in itself. Features remaining from Vernacular Landscape historic agricultural activities, such as tailwater pond, fencing, corrals, outhouse, lateral irrigation ditches, are left as is without active management unless there is a management conflict (such as for safety) would have direct, long-term, moderate, adverse effects.
No active vegetative restoration of dirt roads and removal of old asphalt on Ruins Road but no active vegetative restoration would have direct, short-term, minor, adverse effects. Direct, short-term, minor, adverse effects if goats cause an increase in erosion or if they consume native vegetation that is compatible with the Historical Vernacular Landscape. Removal of features from Vernacular Landscape only when they conflict with management objectives would have no adverse effect because vernacular features are not as visible as features just north of main ruins.

Impacts would be similar to Alternative 2 (Proactive Vegetation/Cultural Landscape Management) for the Ancient Aztec landscape except treatment of non-native vegetation using non-chemical alternatives would only have direct, short-term, minor, beneficial impact. Mechanical cuts are required to prevent resprouts in future years. Preserving and protecting existing native vegetation and allowing native vegetation to revegetate naturally would have direct, long-term, minor, beneficial effects. No active planting of native woody shrubs and herbaceous vegetation and monitoring progress and interceding where appropriate with native plantings would have direct, short-term, minor, beneficial impacts.

Not removing or recontouring features, such as pushpiles, well pad, gas line routes, and no active vegetative restoration of modern homesite or dirt roads would have direct, long-term, moderate, adverse impacts to the areas directly affected since the action of no removing would mean that the noncontributing features remain.

Cumulative Impacts: The historic and ecological integrity of the two eligible landscapes (Aztec Ruins Historic District Landscape and Ancient Aztec Landscape) would be somewhat improved. However, the improvement would not be as significant as in Alternative 2 due to lack of active restoration of the natural environment.

Conclusion: Overall, there would be no adverse effects and the two eligible landscapes would have direct, long-term, minor, beneficial effects through the removal of non-natives.

HISTORICAL STRUCTURES

Affected Environment

The Aztec Ruins Historic District consists of 2.35 acres and includes the administrative and picnic grounds, which were identified in the 1942 Master Plan. The administrative area is composed of the monument entrance, the parking lot, Visitor Center, including the north patio and nearby rocked irrigation ditch, and the picnic grounds, but not the maintenance area.

The monument was listed on the National Register in 1966, and the Aztec Ruins Historic District Landscape is a significant part of the monument's integrity. The Aztec Ruins Historic District Landscape has historical significance at the state level for its association with American government, recreation and culture, with a period of significance from 1931 to 1939.

The Historic District Landscape contains examples of work accomplished by crews mobilized by a forward thinking president to move our country through the Depression of the 1930s. The landscape also has significance for its association with 20th century American culture because it was the home and work site of a dedicated and honored American archeologist, Earl Morris. The second period of significance is 1919-1952. Morris constructed a home at the site in 1919. The history of changes to the site’s landscape

suggests the history of American archeology and changes in philosophical approaches from the early days of archeology and NPS involvement to the present. The landscape was designed and developed as a New Deal project and, as such, included use of native plant materials and local building traditions, primarily adobe and stucco. Some adobe walls still exist in the building, as do cobble, cement, and stucco walls around the Visitor Center.

The landscape associated with historic structures at Aztec Ruins National Monument represents components of time that are part of the site history; while included in the entire cultural landscape of the monument, it is still to be managed in a way that recognizes the unique history of the Historic Designed Landscape and possible impacts to properties within the Aztec Ruins Historic District.

Impacts of Alternative 1 – No Action

Maintaining all eligible or contributing structures would have a direct, long-term, minor, beneficial impact. Under the no action alternative, ineligible structures would deteriorate, with long-term, indirect, minor adverse effects to the structures.

Cumulative Impacts: The no action alternative would maintain historic structures in their current condition. Over time, the incremental introduction of modern materials into both historic and prehistoric architectural features would adversely affect the integrity of the original structures, but this effect is minor and necessary to maintain them in good condition. Documentation and monitoring of such maintenance provides mitigation of these adverse effects.

Conclusion: The no action alternative has no adverse effects, and provides generally beneficial effects that maintain historic structures in good condition. There are minor impacts that are mitigated through documentation and monitoring.

Impacts of Alternative 2 – Proactive Vegetation/Cultural Landscape Management

Effective vegetation management would have a direct, long-term, minor, beneficial impact on the historic structures that are prehistoric in age. On other historic structures, effective vegetation management would have few direct effects, but it would improve the scene around the historic structures in the Historic District. Management of the historic rock-lined ditch would have direct long-term, minor, beneficial impact.

Cumulative Impacts: Overall effects would be negligible for historic structures of historic age. This alternative would contribute toward preservation of prehistoric structures in their current condition. Cumulative effects would reverse disturbance caused by vegetation, especially within prehistoric ruins.

Conclusion: Alternative 2 has no adverse effects and provides very beneficial effects that maintain historic structures in good condition. Possible impacts from mechanical plant removal would be mitigated through monitoring and implementation of techniques that cause little disturbance. Any identified appropriate use of chemical/herbicide applications for the control of non-native weeds would follow all proper application measures as identified in Appendix B to ensure negligible or no impacts to resources within this unit of the park. This alternative would have direct, long-term, minor, beneficial effect on historic structures that are prehistoric in age in the Historic District

Impacts of Alternative 3 – Limited Vegetation/Cultural Landscape Management

Effective vegetation management would have a direct, long-term, minor, beneficial impact on the historic structures of prehistoric age and have few direct effects on the structures of historic age, but it would improve the scene around the historic structures in the Historic District. Management of the historic rock-lined ditch would have long-term, minor, beneficial impact.

Cumulative Impacts: The effects of this alternative would be similar to alternative 2

Conclusion: Alternative 3 has no adverse effects and provides very beneficial effects that maintain historic structures in good condition. As in alternative 2, the possible impacts from mechanical plant removal would be mitigated through monitoring and implementation of techniques that cause little disturbance. The impacts from chemical/herbicide use in alternative 2 would not be present.

ARCHEOLOGICAL RESOURCES

Affected Environment

Aztec Ruins National Monument contains both prehistoric and historic archeological resources. The West and East ruins, the Hubbard site, nine small mounds, a pueblo known as the Earl Morris Ruin, and numerous remnants of kivas, foundations, walls, terraces, refuse mounds, and middens associated with ancestral Puebloan cultures of the Chacoan period (northwestern New Mexico circa A.D. (900-1150) and the Mesa Verdean period (southwestern Colorado circa A.D. 1130-1300) primarily comprise the Ancient Aztec Landscape (USDI 2001).

A number of outlying ancestral Pueblo sites are present, and these sites vary from small residential sites to large community sites containing residential units in conjunction with public architecture. Other subsurface archeological resources of funerary objects, sacred objects, objects of cultural patrimony, agricultural fields, grid garden plots, and soil detention and water diversion features continue to exist throughout the Monument, and their future identification and assessment should contribute to our further understanding the Ancient Aztec Landscape (USDI 2005).

Impacts of Alternative 1 – No Action

The no action alternative would continue the present state of archeological degradation through erosion. Manual fuel reduction lessens the impacts non-native plant roots can have on the archeological resources but this action, without active native restoration, will exacerbate the erosional problem.

Cumulative impacts: Archeological resources continue to be impacted by variety of natural degradation processes and past disturbances. Well pad construction and utility installation would continue to contribute to erosion of archeological sites, causing indirect, long-term, negligible to minor, adverse impacts. Mitigation efforts to decrease soil disturbance, erosion, bioturbation, and other natural agents of deterioration would minimize these impacts.

Conclusion: Overall, there would be direct, long-term, negligible to minor, impacts due to continued erosion and cumulative effects. Current practices result in adequate archeological resource management, but cumulative effects would gradually impact archeological sites and sometimes result in destruction of more ephemeral archeological resources.

Impacts of Alternative 2 – Proactive Vegetation/Cultural Landscape Management

Removal of vernacular historic features in old fields/cultivated lands and orchards that are noncontributing, such as fencing, outbuildings, corrals, building remains and agricultural features, and regrading, scarifying, and revegetating dirt roads and old Ruins Road bed would include subsurface disturbances that could range from direct, long-term, minor to moderate, and adverse to buried prehistoric resources, but good planning, archeological monitoring, and mitigation (e.g., documentation) could keep

impacts within minor level. Recontouring and regrading in both Core Cultural Area and Upland Zone has potential to cause direct, long-term, moderate, adverse effects through surface disturbance. However, impacts can be mitigated to below the moderate threshold by avoiding significant surface archeological features and conducting archeological monitoring. Backfilling sites that have been pot-hunted in Upland Zone and restoring natural conditions would provide direct, long-term, minor, beneficial impacts by reducing erosion and further vandalism

Restoration of non-native vegetation in the Aztec Ruins Historic District and Developed Areas, especially in the removal of plants in areas where archeological sites are known to occur, would have direct, long-term, negligible to minor, adverse impacts from soil disturbance that should be minimized through archeological monitoring.

Removal of trees, such as Siberian elms, without extracting stumps would be less destructive to subsurface archeological resources. Removal and/or recontouring of irrigation ditches where they impede surface water flow, even if irrigation system including ditches is found eligible, and the removal of overhead power lines and above ground utilities and burial underground would have direct, long-term, minor to moderate, adverse effects to buried prehistoric resource due to subsurface disturbances.

Planning, archeological monitoring, and mitigation (e.g., documentation) could keep impacts within minor level. Actions in Core Cultural Area would have several effects on archeological resources. Removal of elms in the Core Cultural Area, trees along fence lines, and tamarisk and Russian Olive in riparian areas would be direct, long-term, negligible to minor, and adverse in some instances, but there are several sites where the effect would be direct, long-term, moderate, beneficial impacts by reducing heavy root growth and attendant bioturbation. Conversely, limited plantings of visual screens and cottonwood trees would cause future bioturbation in other areas which would result in direct, long-term, minor, adverse impacts.

Removal of orchard trees using mechanical methods, with the stumps also removed, would have no adverse effects if there is no disturbance to buried prehistoric resources. Archeological sites in old fields/cultivated lands and orchards are generally subsurface but identifiable. Proposed planting of native shrubs or similar barriers to prairie dog colonies would have a direct, long-term, moderate, beneficial impact because it would discourage destructive burrowing of buried cultural resources but would also have direct, long-term, minor, adverse impacts on subsurface prehistoric resources due to ground disturbance associated with native plantings.

Native seeding, planting, and watering would have direct, long-term, negligible to minor, adverse impacts due to subsurface disturbances and potential effects to buried prehistoric resources. By not removing the orchard grass, an unnatural condition would be maintained within the park and could potentially increase the potential for wildfire due to the dense cover of this species.

Most mechanical removal techniques in Core Cultural Area would result in direct, long-term, negligible, adverse impacts to surface archeological features and artifacts because of soil disturbance and the need for re-treatments of episodic mechanical removal/chemical treatment. These mechanical removal techniques would also have indirect, long-term, negligible to minor, beneficial impacts because the likelihood of wildfire and intensity would be reduced, and subsurface features would be better protected because the likelihood of plant roots conducting heat beneath the surface and affecting masonry and other buried features is reduced.

In addition, removal of brush on ruins would reduce the plant roots that may be encroaching on wall fabric beneath the surface. Direct, long-term, negligible adverse impacts are possible to wall fabric from the act of cutting brush with mechanical tools. Careful selection and supervision of the crew would mitigate these possible impacts. Chemical treatments and grazing by goats for non-native vegetation removal would have direct, short-term, negligible, adverse effects to due potential impacts on buried prehistoric resources.

Cumulative impacts: The manner in which this alternative would be implemented would create some cumulative impacts to archeological sites that are treated by causing incremental increases in ongoing

surface and shallow subsurface disturbances. Some ongoing cumulative effects (e.g., severe root disturbance from elms and other invasive trees) would be curtailed, resulting in beneficial effects to archeological resources.

Conclusion: Alternative 2 would result in overall beneficial effects with negligible adverse effects. Short-term impacts from treatment procedures would be avoided through selection of minimally invasive procedures and mitigated through archeological monitoring and documentation.

Impacts of Alternative 3 – Limited Vegetation/Cultural Landscape Management

Less active native vegetative restoration, no chemicals for non-native vegetation removal, and fewer vernacular buildings and features removed would result in fewer and/or lower intensity level impacts to archeological resources having direct, short-term, minor, beneficial impacts. Not removing orchard grass and allowing for passive reseeding would have less chance of disturbing subsurface archeological sites having no adverse effect.

Cumulative impacts: The manner in which Alternative 3 (Limited Vegetation/Cultural Landscape Management) would be implemented in this plan would create some cumulative impacts to archeological sites that are treated by causing incremental increases in ongoing surface and shallow subsurface disturbances. Some ongoing cumulative effects (e.g., severe root disturbance from elms and other invasive trees) would be curtailed, resulting in beneficial effects to archeological resources.

Conclusion: Alternative 3 would result in overall in beneficial effects with no adverse effects. Short-term impacts from treatment procedures would be avoided through selection of minimally invasive procedures and mitigated through archeological monitoring and documentation.

Visitor Use and Experience

Health and Safety

The health and safety of visitors, park staff, and neighbors are the highest priority for NPS. According to NPS Management Policies (2006), it states that “While recognizing that there are limitations on its capability to totally eliminate all hazards, the Service and its concessionaires, contractors, and cooperators will seek to provide a safe and healthful environment for visitors and employees.” Treated areas subject to visitation are marked during the no-entry period as described on the herbicide label or until dry to advise visitors against entering treated areas and thus exposing themselves to the chemicals. Meteorological conditions are accounted for in planning to decrease the risk of herbicide drift.

Affected Environment

Aztec Ruins National Monument is open year round except Thanksgiving, Christmas, and New Year’s days. The monument averages about 58,000 visitors per year, and peak visitation occurs from mid-May through September. Because of the monument’s small size, easy access, convenient location, and availability of nearby overnight accommodations, the facilities at the monument are for day use only. The principal visitor activities are touring the Visitor Center/Museum, viewing an orientation film, taking the self-guided tour of the excavated West Ruin, and picnicking. The average length of stay is less than two hours (USDI 2001).

Intensity Level Definitions

To analyze the impacts on visitor use and experience, the Monument used research, scientific literature, visitor use and experience surveys, other park plans, professional judgments and monument staff

insights, public input, and consultation with other permitting agencies. According to the National Park Service's Management Policies (2006), the enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks. The National Park Service would provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in the parks. The methodology used for assessing impacts to visitor use and experience is based on how preservation, restoration, and/or rehabilitation of vegetation and cultural landscapes would affect the visitor, including safety considerations and maintaining the resource for future generations to enjoy. The thresholds for this impact assessment are as follows:

Negligible: Visitors would not be affected or changes in visitor use and/or experience would be below or at the level of detection. Any effects would be short-term. The visitor would not likely be aware of the effects associated with the alternative.

Minor: Changes in visitor use and/or experience would be detectable, although the changes would be slight and likely short-term. The visitor would be aware of the effects associated with the alternative, but the effects would be slight.

Moderate: Changes in visitor use and/or experience would be readily apparent and likely long-term. The visitor would be aware of the effects associated with the alternative, and would likely be able to express an opinion about the changes.

Major: Changes in visitor use and/or experience would be readily apparent and have substantial long-term consequences. The visitor would be aware of the effects associated with the alternative, and would likely express a strong opinion about the changes.

Impacts of Alternative 1 – No Action

To date, no formal studies of visitor perceptions of the monument's vegetation types have been conducted, and the Aztec Ruins National Monument Visitor Study (2003) suggested little about potential vegetation management impacts.

Members of the interpretive staff were informally surveyed about visitor reactions to the pear orchard adjacent to West Ruin (G. Herring, personal communication). Interpreters whose schedules involved the most daily interaction with visitors during the summer months said they get about one unsolicited orchard-related question every week. None received inquiries less than once per month. About 25% of visitors want to know if ancient peoples grew fruit trees, and a similar fraction want to know if the NPS has a visitor apple-picking program. About half of visitors who ask questions about the trees also have an interest in the history of the orchard. Some visitors expressed interest in preserving it "because orchards are becoming scarce in America." Visitor interest in the orchards was most common during formal and informal interpretive contacts, particularly at moments when the interpreter was attempting to draw attention to archeological sites in the fields and hills around West Ruin.

These observations also apply to the apple orchard north of the pear orchard and the riparian area orchard. If future trails or ranger-led activities occur in these areas, these orchards would have a direct, long-term, negligible to minor, adverse impact on visitor experience. If the orchards remain out of view, they should not create a visitor distraction. However, the GMP (USDI 2006) does call for potential trails through and overlooking these areas.

Other non-native vegetation, such as Russian olive, tamarisk, pose an indirect, negligible, adverse impact on visitor experience of the ancestral Pueblo past because visitors generally do not know that these species are not part of the ancestral Puebloan Landscape. The fruit trees are relatively easy for visitors to identify, and the line-row nature of orchards draws attention to the trees, which perhaps leads to more interest and questions. Questions about Russian olives, tamarisk, and other noxious weeds, on the other hand, are less frequent (G. Herring, pers. comm.).

Retention of the lawn around the visitor center would continue to distract visitor understanding of the historic building at the time it was occupied by Earl Morris, who led the American Natural History Museum's archeological excavations, resulting in an indirect, long-term, negligible, adverse impact because few, if any, visitors would likely associate plant cover with the building's historicity.

This alternative would leave the hazard trees unaddressed increasing the risk of visitor health and safety and liability resulting in a direct, long-term, minor to moderate adverse impact.

Cumulative impacts: The proposed North Mesa Trail would give visitors a larger viewscape of pear and apple orchards, old agricultural fields, Farmers Ditch, and historic agricultural features. Extant orchards, which are remnants of the Historic Vernacular Landscape, and non-native vegetation would continue to distract visitor attention and obscure their understanding of the monument's Ancient Aztec Landscape, resulting in direct, long-term, minor, adverse impacts.

Conclusion: The presence of recent-historic landscape features, including orchards, would continue to distract and confuse visitor interest from the primary resource significances identified in the GMP, resulting in indirect, long-term, adverse effects, particularly in proximity to the West Ruin. The impact of outlying orchards on visitor experience would cumulatively increase from negligible impacts during ranger-led activities to minor adverse impacts if trails are built through, near, or overlooking them in the future. Non-native vegetation would continue to have an indirect, long-term, negligible, adverse impact.

Impacts of Alternative 2 – Proactive Vegetation/Cultural Landscape Management

Overall, removal of non-native plants, including remnant orchard trees, would have direct, long-term, negligible to minor, beneficial impacts for visitor understanding of the resource. Returning the riparian area to a more natural environment by removal of the Russian Olive and tamarisk would have a direct, long-term minor, beneficial impact for visitors. Many visitors would likely not notice a difference to their experience, but for some, at least the removal of non-natives, including fruit trees, would evoke a landscape that was at least plausible at the time of ancestral Pueblo occupation.

By restoring conditions that evoke the Ancient Aztec Landscape utilized by ancestral Puebloans, visitors would experience fewer modern or recent-historic visual intrusions that distract from the desired experience recognized by the GMP (USDI, 2006). The presence of a landscape that was at least plausible at the time of ancestral Pueblo occupation, such as native grass or shrub lands, might also make it easier for visitors imagine how it might have looked in the prehistoric past.

Removal of non-native species could have a direct, short-term, negligible, adverse impact caused by restoration efforts (e.g., noise from chainsaws, machinery used to prepare soil, the visual presence of work crews reseeding fields). The brush pile burning could have direct, short-term, negligible, adverse impact on visitors throughout the park. The mitigation efforts of burning only when proper weather conditions exist should alleviate this impact.

The presence of recent-historic landscape features in the Old Fields/Cultivated Lands generally distracts and confuses visitor interest from the primary resource significances identified in the GMP. Removal of such features and replacement with native grass or shrub species would result in direct, long-term, beneficial impacts for the visitor experience in areas visible from the West Ruin trail and when and wherever trails might be built near, through, or overlooking these old fields and cultivated lands in the future. Even without new trails, visitors would experience an indirect, long-term, negligible, beneficial impact if conditions were restored to natural plant communities.

Visitors would likely experience a direct, long-term, negligible, beneficial impact from removal of visual intrusions to their experience of the Morris Home/Aztec Ruins Visitor Center including the historic ditch and restoration of conditions evoking the historic landscape. The results seem negligible since few if any visitors would likely associate plant cover with the building's historicity.

Replacing non-native bluegrass sod with sod forming native species (e.g. buffalo grass) would reduce water use. Removing hazard tree limbs would enhance visitor safety resulting in direct, short-term, moderate, beneficial impacts.

The application of herbicide will be primarily in units of the monument that are closed to public use such as, the old fields/cultivated, the ditch, riparian, and orchard. Within the units of the monument that receive visitor use, herbicide use will be limited and more directed on individual plants. Wind direction will be taken into account during all herbicide use. This will result in indirect, short term, negligible to minor adverse effects.

Cumulative impacts: Over the long term, removal of non-native species would enhance the visitor experience by reducing visual intrusions that distract visitors from the desired experience relative to site significances identified in the GMP.

Conclusion: Overall effects would be direct, long-term, minor, beneficial. In time, the cumulative benefit would override any short-term, negligible impacts caused by physical restoration techniques to native plant communities.

Impacts of Alternative 3 – Limited Vegetation/Cultural Landscape Management

Overall, impacts would be similar to Alternative 2 (Proactive Vegetation/Cultural Landscape Management). However, with less active native vegetative restoration, no chemicals for non-native vegetation removal, and fewer vernacular buildings and features removed, this alternative would have direct, long-term, minor, adverse impacts because some visual intrusions that distract from the visitor experience would still remain. Invasive, noxious weeds that cannot be controlled without chemical treatment would likely expand and potentially spread to other areas of the park. There would also be fewer direct, short-term negligible impacts caused by restoration work (e.g., noise from chainsaws, machinery used to prepare soil, the visual presence of work crews reseeding fields, brush pile burning) because there would be less active native vegetative restoration than under Alternative 2. The impacts from herbicide use would not exist in this alternative.

Cumulative impacts: Over the long term, removal of some non-native species and orchards would enhance the visitor experience by reducing visual intrusions that distraction visitors from the desired experience relative to site significances identified in the GMP.

Conclusion: Overall effects would be direct, long-term, minor, and beneficial but less than Alternative 2 (Proactive Vegetation/Cultural Landscape Management). In time, the cumulative benefit would override any short-term, negligible impacts caused by physical restoration techniques to native plant communities.

Wildlife

Affected Environment

Numerous plant community types at Aztec Ruins National Monument provide diverse habitat for wildlife. Wildlife surveys conducted in 2001-2002, along with supplemental sightings, detected 68 bird species, 26 mammal species, two amphibian species, and nine reptile species within the Monument boundary. Mammalian species identified in the surveys included seven species of bats (see under special status species), desert cottontail (*Sylvilagus auduboni*), black-tailed jack rabbit (*Lepus californicus*), five mouse species, western spotted skunk (*Spilogale gracilis*), mule deer (*Odocoileus hemionus*), rock squirrel (*Spermophilus variegatus*), Gunnison's prairie dog (*Cynomys gunnisoni*), Botta's pocket gopher (*Thomomys bottae*), muskrat (*Ondantra zibethicus*), porcupine (*Erethizon dorsatum*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*), and bobcat (*Lynx rufus*). Avian species in the surveys included Canada Goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), Gambel's quail (*Callipepla gambelii*), black-crowned night-heron (*Nycticorax nycticorax*), turkey vulture (*Cathartes aura*), red-tailed hawk (*Buteo*

jamaicensis), American kestrel (*Falco sparverius*), prairie falcon (*Falco mexicanus*), killdeer (*Charadrius vociferus*), spotted sandpiper (*Actitis macularius*), mourning dove (*Zenaida macroura*), yellow-billed cuckoo (*Coccyzus americanus*), greater roadrunner (*Geococcyx californianus*), barn owl (*Tyto alba*), great horned owl (*Bubo virginianus*), common nighthawk (*Chordeiles minor*), black-chinned hummingbird (*Archilochus alexandri*), ladder-backed woodpecker (*Picoides scalaris*), northern flicker (*Colaptes auratus*), and 46 species of songbirds. Three non-native bird species have been identified within the Monument: ring-necked pheasant (*Phasianus colchicus*), European starling (*Sturnus vulgaris*), and house sparrow (*Passer domesticus*). Amphibians found on the surveys included Woodhouse's toad (*Bufo woodhousii*) and striped chorus frog (*Pseudacris triseriata*); reptiles included common collared lizard (*Crotaphytus collaris*), sagebrush lizard (*Sceloporus graciosus*), eastern fence lizard (*Sceloporus undulatus*), western whiptail (*Cnemidophorus tigris*), plateau striped whiptail (*Cnemidophorus velox*), striped whipsnake (*Masticophis taeniatus*), gopher snake (*Pituophis melanoleucus*), western terrestrial garter snake (*Thamnophis elegans*), and western rattlesnake (*Crotalus viridis*).

Numerous other bird species likely use the Monument on transitory or migratory bases, but were not identified during the surveys. These include, but may not be limited to, the following: wild turkey (*Meleagris gallopavo*), great blue heron (*Ardea herodias*), osprey (*Pandion haliaetus*), bald eagle (*Haliaeetus leucocephalus*), Swainson's hawk (*Buteo swainsoni*), ferruginous hawk (*Buteo regalis*), rough-legged hawk (*Buteo lagopus*), non-native rock pigeon (*Columba livia*), non-native Eurasian collared-dove (*Streptopelia decaocto*), western screech-owl (*Megascops kennicottii*), long-eared owl (*Asio otus*), northern saw-whet owl (*Aegolius acadicus*), broad-tailed hummingbird (*Selasphorus platycercus*), rufous hummingbird (*Selasphorus rufus*), belted kingfisher (*Megaceryle alcyon*), Lewis's woodpecker (*Melanerpes lewis*), red-naped sapsucker (*Sphyrapicus nuchalis*), downy woodpecker (*Picoides pubescens*), hairy woodpecker (*Picoides villosus*), willow flycatcher (*Empidonax traillii*), gray flycatcher (*Empidonax wrightii*), dusky flycatcher (*Empidonax oberholseri*), cordilleran flycatcher (*Empidonax occidentalis*), loggerhead shrike (*Lanius ludovicianus*), northern shrike (*Lanius excubitor*), gray vireo (*Vireo vicinior*), plumbeous vireo (*Vireo plumbeus*), warbling vireo (*Vireo gilvus*), horned lark (*Eremophila alpestris*), cliff swallow (*Petrochelidon pyrrhonota*), bushtit (*Psaltriparus minimus*), brown creeper (*Certhia americana*), rock wren (*Salpinctes obsoletus*), house wren (*Troglodytes aedon*), golden-crowned kinglet (*Regulus satrapa*), ruby-crowned kinglet (*Regulus calendula*), blue-gray gnatcatcher (*Polioptila caerulea*), mountain bluebird (*Sialia currucoides*), Townsend's solitaire (*Myadestes townsendi*), sage thrasher (*Oreoscoptes montanus*), bohemian waxwing (*Bombycilla garrulus*), cedar waxwing (*Bombycilla cedrorum*), black-throated gray warbler (*Dendroica nigrescens*), orange-crowned warbler (*Vermivora celata*), MacGillivray's warbler (*Oporornis tolmiei*), yellow-breasted chat (*Icteria virens*), green-tailed towhee (*Pipilo chlorurus*), vesper sparrow (*Pooecetes gramineus*), savannah sparrow (*Passerculus sandwichensis*), dark-eyed junco (*Junco hyemalis*), Cassin's finch (*Carpodacus cassinii*), pine siskin (*Carduelis pinus*), and American goldfinch (*Carduelis tristis*),

Numerous other mammalian species probably exist in the Monument but were not identified during the surveys. These include, but may not be limited to, the following: *long tailed weasel (Mustela frenata),* raccoon (*Procyon lotor*), ringtail (*Bassariscus astutus*), striped skunk (*Mephitis mephitis*), least chipmunk (*Tamias minimus*), and grey fox (*Urocyon cinereoargenteus*).

Fish that are known to exist in the Animas River include the following native species: bluehead sucker (*Catostomus discobolus*), flannelmouth sucker (*Catostomus latipinnis*), speckled dace (*Rhynichtys osculus*), and mottled sculpin (*Cottus bairdi*). The following non-native species are known to exist in the Animas River: white sucker (*Catostomus commersoni*), common carp (*Cyprinus carpio*), brown trout (*Salmo trutta*), rainbow trout (*Onchorhynchus mykiss*), cutthroat trout (*Onchorhynchus clarki*), smallmouth bass (*Micropterus dolomieu*), largemouth bass (*Micropterus salmoides*), green sunfish (*Lepomis cyanellus*), fathead minnow (*Pimephales promelas*), channel catfish (*Ictalurus punctatus*), and black bullhead (*Ictalurus melas*).

Intensity Level Definitions

To analyze the impacts on wildlife resources, the Monument used research, scientific literature, wildlife surveys (See web links section in references), vegetation (habitat) surveys, other park plans, professional judgments and monument staff insights, public input, and consultation with other permitting agencies. Native wildlife populations can be compromised or threatened by changes in habitat features, including vegetation. According to the National Park Service's Management Policies (2006), the National Park Service would strive to preserve fundamental physical and biological processes, as well as individual species, features, and plant and animal communities. The Service would try to maintain all the components and processes of naturally evolving park ecosystems, including the natural abundance, diversity, and genetic and ecological integrity of the wildlife species native to those ecosystems. Just as all components of a natural system would be recognized as important, natural change would also be recognized as an integral part of the functioning of natural systems. For the purposes of analyzing potential impacts, the intensity thresholds are as follows:

Negligible: Impacts would have no measurable or perceptible changes in wildlife community composition, abundance, distribution, or ecological integrity.

Minor: Impacts would be measurable or perceptible but would be localized within a relatively small area. The overall viability of the wildlife community would not be affected and, if left alone, would recover.

Moderate: Impacts would cause a change in the wildlife community composition, abundance, distribution, or ecological integrity; however, the impact would remain localized.

Major: Impacts to the wildlife community would be substantial, highly noticeable, and permanent.

Impacts of Alternative 1 – No Action

The no action alternative in uplands and slopes, which have been less disturbed by humans, would result in negligible impact on wildlife if the abundance of non-native plants remains low in these zones.

Lack of restoration to natural plant communities in zones currently occupied by non-native plants would result in negligible impacts to wildlife communities that currently exist in those zones if the plant community does not change significantly from current conditions. However, this alternative would not improve conditions and usable habitat for wildlife species that depend on native vegetation for forage, shelter, and raising young. It would also not increase and promote diversity of wildlife, and it would continue to exclude some native species.

It is expected, however, that without action, the zones of higher disturbance would experience increased non-native plant establishment and concurrent decrease in native plants (Howe and Knopf, 1991). This may be particularly noticeable in the riparian/floodplain as Russian olive and tamarisk continue to outcompete native woody vegetation, such as cottonwoods and willows, as well as forbs and grasses. While Russian olive may provide some structural habitat and forage for some wildlife, it is generally not beneficial for wildlife diversity. If this alternative results in monocultures of tamarisk and/or Russian olive, this is likely to decrease the value to wildlife, particularly if monoculture stands also result in lack of structural diversity (Fleishman et al. 2003, Walker 2008).

If plant communities in any zone shift to greater abundance of non-native plants or to non-native plants that are of less value to wildlife (e.g., tamarisk, Kerpez and Smith 1987, Griffin et al. 1989, Anderson and Miller 1990, Rosenberg et al. 1991, Bailey et al. 2001), the impacts to native wildlife would be indirect, long-term, minor to moderate, and adverse for many, but not all, species of native wildlife.

Cumulative impacts: Non-native plant species have the potential to be dispersed by wind and wildlife (seed dispersers and pollinators) to adjacent properties and eventually spread throughout the region. Native wildlife species, in general, benefit from native plant communities; therefore, no action may result in indirect long-term, moderate, adverse impacts. These long-term, moderate, adverse impacts may extend beyond the Monument's boundaries by impeding wildlife movements, gene flow, and by being a potential sink for some wildlife species.

Conclusion: . The present condition which leaves a large part of Monument property in non-native plant cover is having an indirect long-term minor to moderate adverse effect on native wildlife by limiting suitable habitat. If there is no shift in plant communities to an increased non-native component, there would be negligible impacts to wildlife species that currently exist in those communities. However, this alternative does not take advantage of opportunities to improve natural processes and conditions for native wildlife. Furthermore, if non-native plant establishment increases, impacts to native wildlife communities would be indirect, long-term, moderate, and adverse because this would decrease useable habitat and foraging opportunities.

Impacts of Alternative 2 – Proactive Vegetation/Cultural Landscape Management

Wildlife surveys conducted in 2001-2002, along with supplemental sightings, detected 68 bird species, 26 mammal species, 2 amphibian species, and 9 reptile species within the Monument's boundaries. The overall impacts to the majority of these wildlife species for all vegetation zones would be direct and indirect, long-term, minor to moderate, and beneficial because this alternative emphasizes preservation and promotion of native plant communities as well as elimination of non-native plant species that are of little to no value for many native wildlife species.

Some wildlife species, however, are known to regularly occupy, or even prefer, disturbed habitat (Hill 1993, Fernández-Juricic 2001, Fernández-Juricic et al. 2003, Ortega and Francis 2007); for these species, the overall impacts would be direct and indirect, long-term and short-term, minor, and adverse. Many species that are attracted to disturbed habitat are either non-native (e.g., house mice [*Mus musculus*], house sparrows, rock-pigeons, Eurasian collared doves, European starlings) or native species whose population numbers are increasing or stable on a nationwide scale (e.g., house finches [*Carpodacus mexicanus*] and American robins [*Turdus migratorius*], Sauer et al. 2008).

Restoration of natural plant communities in zones currently occupied by non-native plants would have indirect, long-term, moderate, beneficial impacts on native wildlife species. This alternative would increase the useable acreage of natural habitat for wildlife and promote occupancy by wildlife species that depend on native vegetation for forage, shelter, and raising young.

Restoration of the old fields zone and revegetation of well pads, dirt roads, and homesites would have indirect, long-term, moderate, beneficial impacts by increasing suitable habitat for snakes, lizards, rodents, songbirds (especially sparrows), and raptors.

Removal and control of non-native vegetation, such as tamarisk and Russian olive in the riparian zone, and planting of native trees, such as willow, cottonwood and other trees and shrubs that are appropriate to achieve diversity, would provide greater structural diversity, ground cover, and more vegetation layers.

Restoration of the native riparian plant community would have indirect, long-term, moderate, beneficial impacts on wildlife because it would increase biodiversity and provide habitat and greater foraging opportunities for species that are generally absent in riparian areas composed primarily of non-native trees (Knopf and Olson 1984, Brown 1990, Stoleson and Finch 2001).

Changes in wildlife communities in zones that are less disturbed by natural and anthropogenic causes would be less noticeable than in more disturbed zones; however, changes to these less-disturbed zones are expected to result in indirect, long-term, minor, beneficial impacts through replanting and seeding of native species. Additionally, continuity of native habitat would increase the likelihood of occupancy by

wildlife species that have larger home ranges and would facilitate natal dispersal, seasonal migration, and gene flow (Wiens 1994, Ruefenacht and Knight 1995, Bolen and Robinson 1998, Bennett 1999, Dobson et al. 1999).

The removal of the orchard will have a minor to negligible, short-term, indirect, adverse impact on the deer that frequent the orchard and surrounding area. The orchard will be replaced by native species, which would increase the continuity of native habitat throughout the park, providing suitable habitat for the deer population and other native wildlife species. This would ultimately result in long-term, minor, beneficial impacts to all native wildlife species.

This alternative would use all possible tools to treat non-native vegetation including mechanical, biological (insects), chemical, cultural (to include goat or appropriate animal use), and/or fire. Some chemicals would have direct, short-term, minor, adverse impacts on native vegetation. Therefore, there would also be indirect, short-term, minor, adverse impacts to wildlife because temporary habitat modification and disturbance of the treatments would displace some individuals. Mitigation efforts for use of chemicals should prevent most direct, short-term, adverse impacts to wildlife.

Vegetation management, such control of vegetation on mounds, in the core cultural area would have direct and indirect, short-term minor, adverse impacts on wildlife because it would remove potential vegetated habitat and foraging opportunities. Removal of vegetation, such as bindweed, from walls of the ruins would have a negligible impact on wildlife. Removal of sod grass and restoration of the core cultural area to a native condition would have long-term, minor, beneficial impacts to most, but not all, native wildlife.

The impacts of brush pile burning on wildlife would generally have indirect, short-term, negligible, adverse impacts on some wildlife. Disturbance of soil from removing the tailwater drainage pipe in the core cultural area would have direct and indirect, short-term, minor, adverse impacts because it would remove existing native vegetation.

Fencing to restrict grazing by neighboring livestock would have direct and indirect, long-term, minor, beneficial impacts because it is likely to reduce brown-headed cowbird (*Molothrus ater*) parasitism and thereby increase nest success for many species of songbirds (Bock et al. 1993, Ortega 1998, 2004, Curson et al. 2000, Ortega and Ortega 2000, 2001). It would also increase use by ground nesting birds. The impact would be minor because this is a small area of the Monument.

Use of goats for control of non-native plants would vary. If goats are used during the breeding season, direct and indirect, short-term, minor, adverse impacts would be expected because goats attract cowbirds; however, there would be direct and indirect, long-term, minor, beneficial impacts because it would improve conditions of the native plant community.

Fencing to control prairie dogs would eliminate suitable habitat for them and would displace prairie dogs and may also displace other wildlife species associated with prairie dog towns, such as coyotes (*Canis latrans*), rabbits, snakes, and raptors (Ceballos et al. 1999, Kotliar et al. 1999). However, because the area is a small section of the Monument, the adverse impacts would be minor. Additionally, non-lethal and non-invasive methods of controlling prairie dogs, such as native vegetative barriers, including big sagebrush, silver sagebrush (*Artemisia cana*), Douglas rabbitbrush (*Chrysothamnus viscidiflorus*), and rubber rabbitbrush, would have indirect, long-term, minor, beneficial impacts on other native wildlife that require shrub communities.

Relocating overhead utilities to an underground placement would have direct and indirect, long-term, minor, beneficial impacts as well as direct and indirect, short-term, minor, adverse impacts. A wide variety of birds use overhead utilities for resting, roosting, and hunting perches. However, many birds also are electrocuted as a result of their use of overhead utilities (Olendorff et al. 1981, Bevanger 1994, Kochert and Olendorff 1999, Lehman et al. 2006, Dwyer and Mannan 2007). The long-term impacts on wildlife would be minor and beneficial because the management action would promote more natural conditions and encourage birds to use more natural perches.

Limiting and monitoring social trails would have direct and indirect, short-term and long-term, moderate, beneficial impacts for most wildlife species because many wildlife species are adversely affected by trails (Miller et al. 1998, Sauvajot et al. 1998, Miller and Hobbs 2000, Francl et al. 2004), and the adverse effects are usually exacerbated by human disturbance on trails (Jalkotzy et al. 1997, Miller et al. 1998, Miller and Hobbs 2000, Taylor and Knight 2003).

Removal of existing irrigation ditches may have direct and indirect, short-term and long-term, minor, adverse impacts on some wildlife species that have become dependent on water from irrigation ditches, especially bats, other mammals, and amphibians. The impact would be minor because there are other water sources from ditches nearby.

The impact of chemical use to eliminate and control non-native plants would vary from direct and indirect, short-term and long-term, minor to moderate, beneficial, and adverse. The long-term, moderate, beneficial impacts would be due to the effective elimination and control of non-native plants that cannot be treated with efficacy using non-chemical methods. In some cases, short-term, adverse impacts would be minor because some wildlife species may be temporarily displaced, and food sources may be temporarily eliminated. Short-term impacts can be reduced through timing and method of chemical application (see mitigation measures).

The impact of using mechanical equipment for control of non-natives and restoration would be direct, short-term, minor, and adverse because many wildlife species are disturbed by human activity and noise (Reijnen et al. 1995, Forman and Deblinger 2000, Brotons and Herrando 2001, Canaday and Rivadeneyra 2001, Fernandez-Juricic 2001, Ortega and Francis 2007); this disturbance can be minimized by timing the activities outside the breeding season.

Development of restoration demonstration areas for educational purposes and seeking cooperative community opportunities would have potential indirect, long-term, moderate, beneficial impacts on wildlife because these efforts would encourage and promote restoration outside the Monument and possibly contribute to habitat continuity.

In general, prioritizing for a native and natural plant community and controlling non-native plants would have indirect, long-term, moderate, beneficial impacts on native wildlife communities because it would provide native habitat and promote more natural foraging conditions. Treatments, such as protecting subsurface cultural materials and continued maintenance of stucco walls and buildings, painting, and parking lot paving, would have negligible, if any, impact on wildlife.

Cumulative impacts: Active restoration of the native plant community would result in increased useable habitat for native wildlife species within the Monument and potentially outside the Monument. Controlling weeds and restoring native plant communities would decrease contribution of seed dispersal of weeds and increase dispersal of native plants (through wildlife that are seed dispersers or pollinators) on a regional level, which would have potential direct and indirect, long-term, minor to moderate, beneficial impacts on wildlife outside the Monument. This would also facilitate migration and dispersal by providing the opportunity for more contiguous native habitat. A more functional native community may also provide conditions that promote source populations, which may feed other populations on outside the park or on a more regional level.

Conclusion: The overall impacts to native wildlife would be direct and indirect, long-term, minor to moderate, and beneficial because this alternative focuses on restoration and preservation of native plant communities, which would increase useable habitat and promote diversity.

Impacts of Alternative 3 – Limited Vegetation/Cultural Landscape Management

The treatments are the same as Alternative 2 except non-native vegetation would be treated using non-chemical alternatives, and active restoration would be limited. There would be direct and indirect, long-

term, moderate, adverse impacts for the wildlife species that would benefit the most by elimination of non-native species and restoration of the natural plant community because many non-native plant species, e.g., Russian olive and tamarisk, and other non-native plants cannot be controlled without chemicals. The lack of active planting of native shrubs and trees in the riparian/floodplain would have a short-term, adverse, moderate impact on wildlife if native trees and shrubs resprout on their own; if they do not resprout on their own and are out-competed by non-native species, there would be direct and indirect, long-term, moderate, adverse impacts to wildlife.

The lack of active restoration and recontouring of recent anthropogenic features, such as well pads, pushpiles, road, homesites, fences, and corrals, would have indirect, long-term, minor, adverse impacts to wildlife because most wildlife species would benefit by restoration of these features by increasing the quantity and quality of habitat and foraging opportunities.

Cumulative impacts: Non-native plants that require chemical treatments or are effectively controlled only with chemical treatments would be difficult to eradicate and, thereby, not contribute to improved conditions for native wildlife. If the non-native plant community increases or shifts to non-native species that are of less value to native wildlife, this alternative could result in indirect, long-term, minor to moderate, adverse impacts. Non-native plant species have the potential to be dispersed by wind and wildlife to adjacent properties and eventually spread throughout the region. Native wildlife species, in general, benefit from native plant communities; therefore, ineffective treatment of non-native plants may result in indirect, long-term, minor to moderate, adverse cumulative impacts.

Conclusion: If there is no shift in plant communities, there would be a negligible impact to the wildlife species that currently exist in those communities. If non-native plant establishment increases, impacts to native wildlife communities would be indirect, long-term, moderate, and adverse because this would decrease useable habitat and foraging opportunities.

Special Status Species/Species of Concern

Affected Environment

For the purposes of this analysis, the U. S. Fish and Wildlife Service and the State of New Mexico Department of Game and Fish were contacted with regards to federally listed and state listed species to determine those species that could potentially occur in the Monument. An email, dated 22 August, 2012, from the U. S. Fish and Wildlife Service does not identify any Federally-endangered or threatened species and refers to the State of New Mexico for identification of state-listed species.

The email from the U. S. Fish and Wildlife Service refers to the Migratory Bird Treaty Act (MBTA) signed by the United States in 1918. MBTA prohibits the taking of migratory birds, stating, “Unless and except as permitted ... it shall be unlawful at any time, by any means or in any manner, to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, possess, … any migratory bird, any part, nest, or eggs of any such bird, or any product, whether or not manufactured, which consists, or is composed in whole or part, of any such bird or any part, nest, or egg thereof, included in the terms of the conventions between the United States...”. It is suggested that activities that would adversely affect birds in a project area occur outside the avian breeding season (March through August).

The email also stated that under Executive Orders 11988 and 11990, Federal agencies are required to minimize the destruction, loss, or degradation of wetlands and floodplains, and preserve and enhance their natural and beneficial values. And recommended we contact the U.S. Army Corps of Engineers for permitting requirements under section 404 of the Clean Water Act if our proposed action could impact floodplains or wetlands. These habitats should be conserved through avoidance, or mitigated to ensure no net loss of wetlands function and value.

An email from the State of New Mexico Department of Game and Fish in August, 2012, identified 35 species on the New Mexico list of wildlife of concern that exist within San Juan County. Of these species, nine have been observed in the Monument: yellow-billed cuckoo (*Coccyzus americanus occidentalis*), western small-footed myotis (*Myotis ciliolabrum melanorhinus*), Yuma myotis (*yumanensis yumanensis*), spotted bat (*Euderma maculatum*), big free-tailed bat (*Nyctinomops macrotis*),Townsend's big-eared Bat (Corynorhinus townsendii), western spotted skunk (*Spilogale gracilis*), Gunnison's prairie dog (*Cynomys gunnisoni*), and red fox (*Vulpes vulpes*); four are likely to occur in the Monument: bald eagle (*Haliaeetus leucocephalus*), loggerhead shrike (*Lanius ludovicianus*), Southwestern willow flycatcher (Empidonax trailii extimus), and gray vireo (*Vireo vicinior*)).

Intensity Level Definitions

To analyze the impacts on special status species and species of concern, the Monument used research, scientific literature, wildlife surveys (See web links section in references), vegetation E, or invasive species. According to the National Park Service's Management Policies (2006), the National Park Service would strive to preserve fundamental physical and biological processes, as well as individual species, features, and plant and animal communities. The Service would try to maintain all the components and processes of naturally evolving park ecosystems, including the natural abundance, diversity, and genetic and ecological integrity of special status species native to those ecosystems. Just as all components of a natural system would be recognized as important, natural change would also be recognized as an integral part of the functioning of natural systems. For the purposes of analyzing potential impacts, the intensity thresholds are as follows:

Negligible: Impacts would have no measurable or perceptible changes in community composition, abundance, distribution, or ecological integrity of special status species/species of concern.

Minor: Impacts would be measurable or perceptible but would be localized within a relatively small area. The overall viability of special status species/species of concern community would not be affected and, if left alone, would recover.

Moderate: Impacts would cause a change in the community composition, abundance, distribution, or ecological integrity of special status species/species of concern; however, the impact would remain localized.

Major: Impacts to the community of special status species/species of concern would be substantial, highly noticeable, and permanent.

No species currently protected under the Federal Endangered Species Act is known to exist within the Monument boundaries. However, nine vertebrate species (eight mammal species, and one bird species) that have been observed within Monument boundaries are on several lists of concern, and three additional species on the same lists are likely to occur in the Monument.

There are three species protected under the Federal Endangered Species Act that are presently not found on the Monument, but could re-establish populations as suitable habitat is restored. (Table 3).

Table 3 – Species of concern that have been observed or are likely to occur within the boundaries of Aztec Ruins National Monument, New Mexico.

	USFWS	NMGF
Species observed within the Monument		
Yellow-billed cuckoo *Coccyzus americanus occidentalis*	C	s
Western small-footed myotis *Myotis ciliolabrum melanorhinus*		s
Yuma myotis *Myotis yumanensis yumanensis*		s
Spotted bat *Euderma maculatum*		T
Big free-tailed bat *Nyctinomops macrotis*		s
Townsend's big-eared bat *Corynorhinus townsendii*	SOC	s
Western spotted skunk *Spilogale gracilis*		s
Gunnison's prairie dog *Cynomys gunnisoni*		s
Red fox *Vulpes vulpes*		s
Additional species that are likely to occur in the Monument		
Bald eagle *Haliaeetus leucocephalus*		T
Loggerhead shrike *Lanius ludovicianus*		s
Gray vireo (*Vireo vicinior*)		T
Species that may repopulate with improved habitat		
Southwestern willow flycatcher (Empidonax traillii extimus)	E	E
Colorado pikeminnow (Ptychocheilus lucius)	E	
Razorback sucker (Xyrauchen texanus)	E	

Table Key

E: Endangered
T: Threatened
C: Candidate
SOC: Species of Concern
s: Sensitive

Impacts of Alternative 1 – No Action

The no action alternative in uplands and slopes, which have been less disturbed by humans, would result in negligible impact on wildlife species of concern if the abundance of non-native plants remains low in these zones. However, an increase in abundance of non-native plants in these zones could result in indirect, long-term, minor to moderate, adverse impacts on species of concern.

In the zones currently dominated by non-native vegetation, the no action alternative would not improve conditions for most wildlife species, including species of concern. It is expected that in these zones of higher disturbance, non-native plants would increase in abundance, further deteriorating conditions for most species of concern. Furthermore, lack of restoration would not promote native habitat and natural ecological processes, including healthy and natural foraging and breeding conditions, which is the basis of concern for these species.

This alternative would have an indirect, long-term, minor beneficial impact on the Gunnison's prairie dog and possibly the red fox with the continuation of the open fields which provides suitable habitat for the prairie dog. The continued existence of irrigation ditches would have an indirect, long-term, minor beneficial impact on the bat species of special concern.

Cumulative impacts: Non-native plant species have the potential to be dispersed by wind and wildlife to adjacent properties and eventually spread throughout the region. Most wildlife species of concern that have been observed in the Monument benefit from native plant communities; therefore, no action may result in indirect, long-term, moderate, adverse impacts.

Conclusion: This alternative does not take advantage of opportunities to improve natural processes and habitat conditions for species of concern within the Monument, nor does it take advantage of the opportunity to contribute to native habitat continuity and connectivity on a more regional basis. If non-native plant establishment increases, impacts to these species of concern would be indirect, long-term, moderate, and adverse because this would decrease useable habitat and foraging opportunities.

Impacts of Alternative 2 – Proactive Vegetation/Cultural Landscape Management

In general, restoration to healthy native plant communities would have direct, long-term, moderate, beneficial impacts on all species of concern because all are adapted to and prefer native habitat and thrive with natural ecological processes. All of these species are on lists of concern due to decrease and/or degradation of natural habitat.

Restoration of natural plant communities in zones currently occupied by non-native plants would have the most noticeable effect. This alternative would increase the useable acreage of natural habitat and promote occupancy by these wildlife species of concern for forage, shelter, and raising young. The zones that are less disturbed by natural and anthropogenic causes would have less of an impact; however, changes to these less-disturbed zones are expected to result in indirect, long-term, minor, beneficial impacts through replanting and seeding of native species. Additionally, continuity of native habitat would increase the likelihood of occupancy by wildlife species of concern that have larger home ranges and would facilitate natal dispersal, seasonal migration, and gene flow (Wiens 1994, Ruefenacht and Knight 1995, Bolen and Robinson1998, Dobson et al. 1999).

The U.S. Fish & Wildlife Service, in their communication with us, recommended that we continue development of the riparian habitat by removing any nonnative species such as Russian olive (*Elaeagnus angustifolia*) from the riparian area, which is what the plan proposes to do. This could result in indirect, long-term, negligible to minor, beneficial impacts on the Yellow-billed cuckoo, and the Southwestern willow flycatcher. The USFW also noted that they saw nothing in the plan that would have an effect on the two fish included on the list.

Fencing to control prairie dogs would eliminate suitable habitat for them and would displace prairie dogs and may also displace red foxes (*Vulpes vulpes*). However, because the area is a small section of the Monument, the adverse impacts would be minor. Additionally, non-lethal and non-invasive methods of controlling prairie dogs, such as native vegetative barriers, including big sagebrush, silver sagebrush, Douglas rabbitbrush, and rubber rabbitbrush, would have indirect, long-term, minor, beneficial impacts on other native wildlife that require shrub communities.

Removal of existing irrigation ditches may have direct and indirect, short-term and long-term, minor, adverse impacts on bats of concern that have become dependent on water from irrigation ditches (Fujioka and Lane 1997, Peck and Lovvorn 2001, Fernald and Guldan 2006). The impact would be minor because there are other water sources from nearby ditches.

The impact of chemical use to eliminate and control non-native plants would vary from direct and indirect, short-term to long-term, minor to moderate, adverse, and beneficial. The long-term, moderate, beneficial impacts would be due to the effective elimination and control of non-native plants that cannot be treated with efficacy using non-chemical methods. In some cases, indirect, short-term impacts would be minor and adverse because some wildlife species of concern may be temporarily displaced, and food sources may be temporarily eliminated. Direct, short-term, adverse impacts can be reduced through timing and method of chemical application.

The impacts of using mechanical equipment for control of non-natives and restoration would be direct and indirect, short-term, minor, and adverse because many wildlife species are disturbed by human activity and noise (Reijnen et al. 1995, Forman and Deblinger 2000, Brotons and Herrando 2001, Canaday and Rivadeneyra 2001, Fernandez-Juricic 2001, Ortega and Francis 2007); this disturbance can be minimized by timing the activities outside the breeding season.

Cumulative impacts: Active restoration of the native plant community would result in increased useable habitat for species of concern within the Monument and potentially outside the Monument. Controlling weeds and restoring native plant communities would decrease contribution of seed dispersal of weeds and increase dispersal of native plants (through seed dispersers and pollinators) on a regional level, which would have potential indirect, long-term, minor to moderate, beneficial impacts on species of concern outside the Monument and would facilitate migration and dispersal by providing the opportunity for more contiguous native habitat.

Conclusion: The overall impacts to species of concern would be direct and indirect, long-term, minor to moderate, and beneficial because this alternative focuses on restoration and preservation of native plant communities, which would increase useable habitat and habitat diversity for special status species/species of concern.

Impacts of Alternative 3 – Limited Vegetation/Cultural Landscape Management

The treatments are the same as Alternative 2 (Proactive Vegetation/Cultural Landscape Management) except non-native vegetation would be treated using non-chemical alternatives, and active restoration would be limited. There would be indirect, long-term, moderate, adverse impacts for the species of concern that would benefit the most by elimination of non-native species and restoration of the natural plant community because many non-native species cannot be controlled without chemicals.

If recent anthropogenic features, such as well pads, pushpiles, road, homesites, fences, and corrals, are not recontoured and restored, there would be indirect, long-term, minor, adverse impacts to species of concern because most would benefit from restoration of these features by increasing the quantity and quality of habitat and foraging opportunities.

Cumulative impacts: Non-native plants that require chemical treatments or are effectively controlled only with chemical treatments would be difficult to eradicate and, thereby, not contribute to improved conditions for the species of concern. If the non-native plant community increases or shifts to non-native

species that are of less value to native wildlife, this alternative could result in indirect, long-term, minor to moderate, adverse impacts. Non-native plant species have the potential to be dispersed by wind and wildlife to adjacent properties and eventually spread throughout the region. In general, the species of concern benefit from native plant communities; therefore, ineffective treatment of non-native plants may result in indirect, long-term, minor to moderate, adverse impacts.

Conclusion: If there is no shift in plant communities, there would be a negligible impact to the special status species/species of concern species that currently exist in those communities. If non-native plant establishment increases, impacts to native wildlife communities, including special status species/species of concern, would be indirect, long-term, moderate, and adverse because this would decrease useable habitat and foraging opportunities.

Water Resources

Affected Environment

Water resources within the Monument include the Animas River, 1,219 meters of the Farmers Ditch, three main lateral ditches (two piped), several secondary lateral ditches, groundwater, and surface water. Farmers Ditch runs through the Monument (see Fig. 1) and has altered the hydrologic flow by artificially raising the groundwater. A hydrology study initiated in 2005 focused on identifying water sources that impact cultural resources within the Monument and suggesting measures to mitigate impacts and provide protection of cultural resources from further deterioration.

Intensity Level Definitions

To analyze the impacts on water resources, the Monument used research, scientific literature, a site specific hydrology study, soil inventory, vegetation (habitat) surveys, wildlife (habitat use) surveys, other park plans, professional judgments and monument staff insights, public input, and consultation with other permitting agencies. Water resources can be threatened by changes in habitat features, including vegetation and subsequent use of vegetation by wildlife communities, and vegetation may be threatened by physical soil disturbance, physical removal, or invasive species. Water resources can also be threatened by climate change and changes in topography, land use, soil erosion, and contamination. According to the National Park Service's Management Policies (2006), the National Park Service would strive to preserve fundamental physical and biological processes, including water resources. The Service would try to maintain all the components and processes of naturally evolving park ecosystems, including the role of water resources in those ecosystems. Just as all components of a natural system would be recognized as important, natural change would also be recognized as an integral part of the functioning of natural systems. For the purposes of analyzing potential impacts, the intensity thresholds are as follows:

Negligible: Impacts would have no measurable or perceptible changes in water resources – either quantity or quality.

Minor: Impacts would be measurable or perceptible but would be localized within a relatively small area. The overall quantity or quality of water would not be affected and, if left alone, would recover.

Moderate: Impacts would cause a change in either quantity or quality of water; however, the impact would remain localized.

Major: Impacts to either quantity or quality of water would be substantial, highly noticeable, and permanent.

Impacts of Alternative 1 – No Action

Activities from current and planned gas wells, including drilling, roads, and traffic on roads could present some water quality issues through direct physical effects (e.g., storm runoff over eroded soils) and with potential discharge through wells. No action would result in a direct, long-term, minor, adverse impact. Runoff from other farms through the Farmers Ditch is not a significant concern for water quality. Lawns in the Aztec Ruins Historic District and Park Developed area are watered with city water; there are no significant impacts of this activity on water resources.

The field that is grazed by neighboring livestock is also irrigated by the neighbor. Cattle graze on the land 6-7 months during the year. The combined impact of grazing and irrigation activities is not known but could include bacteria and nutrient loading from nitrogenous wastes.

In the riparian/floodplain, tamarisk can cause water quality issues because they draw salts up through their roots and deposit the salts through their leaves onto the soil (Busch and Smith1993). It is not known what the riparian invasive plant community would consist of in the future with no action, but if tamarisk density increases, there could be a direct, long-term, minor to moderate, adverse, impact to water quality.

Cumulative impacts: Without decreasing soil erosion through restoration of a native plant community, water quantity and quality would continue to be compromised. The planned housing development located just to the north of the Monument boundary has potential to increase the impact. Therefore, no action may result in direct, long-term, moderate, adverse impacts.

Conclusion: The overall impacts to water quantity and quality would vary from little to no effect in the Aztec Ruins Historic District and Park Developed area to long-term minor in the uplands, slopes, and fields. In the riparian/floodplain, if no action results in an increasing tamarisk community, impacts to water quality could be direct, long-term, moderate, and adverse.

Impacts of Alternative 2 – Proactive Vegetation/Cultural Landscape Management

Throughout all zones, planting and restoring to a native plant community would minimize erosion and improve surface flow and runoff and, thereby, keep more water on the land (Dabney et al. 2006). Therefore, this option would have direct, long-term, minor to moderate, beneficial impact on water resources. In the uplands and slopes, this alternative would have direct, long-term, moderate, beneficial impacts because there is a greater potential for water runoff and erosion and, therefore, benefits from restoration would be more noticeable. In the flatter areas, such as the old cultivated fields, this alternative would have direct, long-term, minor, beneficial impacts on water resources because erosion does not have as much potential on these flatter areas.

Removing and/or recontouring irrigation ditches would have direct, long-term, moderate, beneficial impacts because this would improve water quantity by allowing water to flow so it infiltrates more; therefore, more water would be available for growth and health of native species.

The use of irrigation water during the establishment of native plants and seeds would have short-term, minor, adverse impacts.

Regrading of the well pads and access roads would decrease runoff resulting in direct, long-term, minor beneficial impact.

In the Core Cultural Area, restoration to a native plant community and elimination of vegetation on mounds and walls would have direct, long-term, minor, beneficial impact because it would minimize erosion and improve surface flow and runoff and, thereby, keep more water on the land (Dabney et al. 2006). Removing the tailwater drainage pipe would have no impact because water does not flow through

the pipe. Recontouring the area of the pond and tailwater pipe would have direct, long-term, minor, beneficial impact because it would improve water flow.

In the Aztec Ruins Historic District and Park Developed Area, the actions under this alternative would have a negligible effect on water quality. There would be direct, long-term, minor, beneficial impact on water quantity because more water would be available, due to decreased water consumption by native species, as compared to the non-natives being replaced. In the Historic Vernacular landscape, this impact would be the same with the removal of the orchards and replacement with native plants. Removal of the trailer would have no impact on water quality, but it would have direct, long-term, moderate, beneficial impacts on water quantity because it would remove the "footprint" and improve permeability of the land (France 2002).

The Russian olive, Siberian elm and tamarisk will be eradicated in the riparian/floodplain. In the northern section, eradicated trees may need to be replaced with planted native trees and shrubs, and the area may also need to be seeded with grasses and forbs. In the southern section, where the river has access to the flood plain, and where there are some new recruits, it is expected that the native community will regenerate by itself with removal of competing non-natives. It is expected that these activities will have a negligible impact on water resources.`

Chemicals that are appropriate for use near water would be used. These chemicals may have a direct, short-term, minor, adverse impact on water quality, but the adverse effects can be mitigated by not applying under rainy or windy conditions and at the appropriate time of the year.

On the uplands and slopes, the chemicals used to eradicate and control non-native plants could result in direct, short-term, minor, adverse impacts to water quality (or long-term intermittent impact if control is needed after initial eradication). In the flatter areas of the Monument, the chemicals used to eradicate and control non-native plants could result in direct, short-term, moderate, adverse impacts to water quality (or long-term intermittent impact depending on how much control is needed after initial eradication); it is moderate compared with the uplands and slopes because there is a potential for the chemicals to remain longer. Long-term impacts would be moderate and beneficial because use of chemicals to control non-natives would improve the chance of restoration success, and the native plant community would have direct, long-term, beneficial impacts on water resources.

Chemicals used to eradicate and control non-native and invasive plants along the Farmers Ditch would result in minor, short-term adverse impact to water quality in the ditch and outside the ditch. Use of chemicals appropriate for use in or near water would mitigate impacts (Hillmer and Liedtke 2003, EPA). Long-term impacts would be moderate and beneficial because use of chemicals to control non-natives would improve the chance of restoration success, and the native plant community would have direct, long-term, beneficial impacts.

If goats are used, they would likely to be used mostly along irrigation ditches. If goats are transient and in low density, they would have no measurable effect on water resources; therefore, the impact of goats would be negligible.

Cumulative impacts: Active restoration of the native plant community would result in increased water quantity and quality by reducing erosion and decreasing water consumption. Additionally, controlling weeds and restoring native plant communities would decrease contribution of seed dispersal of weeds and increase dispersal of native seeds on a regional level, which would have potential direct, long-term, minor to moderate, beneficial impacts, depending on management practices utilized by adjacent property owners. The planned housing development located just to the north of the Monument boundary has potential to alter the patterns of surface water flow, particularly during rain events, increasing the risk of soil erosion. If the development occurs it could have the potential for direct, long term, minor to moderate, adverse impact.

Conclusion: The overall impacts to water resources would be direct, long-term, minor to moderate, and beneficial because this alternative focuses on restoration and preservation of native plant communities, which would minimize soil erosion and improve surface flow and runoff of water.

Impacts of Alternative 3 – Limited Vegetation/Cultural Landscape Management

In the uplands and slopes, the lack of planting and seeding for restoration of native plant community and not using chemicals to treat the non-native plants would result in direct, short-term and long-term, moderate, adverse impacts on water resources because it would not promote a native plant community and it would not improve conditions for soil stability and water runoff.

In the old and cultivated fields, the lack of planting and seeding for restoration of native plant community and not using chemicals to treat the non-native plants would result in direct, short-term and long-term, minor, adverse impacts on water resources because it would not promote a native plant community, and it would not improve conditions for soil stability and water runoff.

Not removing and/or recontouring irrigation ditches would have direct, long-term, minor, adverse impacts because water would not be as available; therefore, there is a potential of native species to decline.

In the Core Cultural Area, the lack of planting and seeding for restoration of native plant community and not using chemicals to treat the non-native plants would result in direct, short-term and long-term, minor, adverse impacts on water resources because it would not promote a native plant community, it would not improve conditions for soil stability and water runoff, and it would be more labor-intensive. Removing the tailwater drainage pipe would have no impact because water does not flow through the pipe. Recontouring the area of the pond and tailwater pipe would have direct, long-term, minor, and beneficial impacts because it would improve water flow.

Not using chemicals to treat non-native and invasive plants along the Farmers Ditch would have no impact on water quality.

In the Aztec Ruins Historic District and Park Developed Area, the actions under this alternative would have negligible effect on water quality. There would be direct, long-term, minor, beneficial impacts on water quantity because more water would be available due to a decrease in water consumption by native species.

In the riparian area, eradication of Russian olive and tamarisk without treating with chemicals would have an unknown impact on water resources. Control of Russian olive and tamarisk is most effective with use of chemicals (Chavez 1996, Caplan 2002). Not using chemicals would result in multiple resprouts (Carman and Brotherson 1982) and formation of dense thickets of both Russian olive and tamarisk, which would not achieve the objectives. If the amount of tamarisk increases, water quality could be compromised because tamarisk trees deposit salt from their leaves onto the soil.

Cumulative impacts: Non-native plants that require chemical treatments or are effectively controlled only with chemical treatments would be difficult to eradicate and, thereby, not contribute to improved conditions for surface water flow and runoff. Therefore, not using effective means to control weeds could result in direct, long-term, minor to moderate, adverse impacts. The planned housing development impact would be the same as in alternative 2.

Conclusion: In the uplands and slopes, the lack of planting and seeding for restoration of native plant community and not using chemicals to treat the non-native plants would result in direct, short-term and long-term, moderate, adverse impacts on water resources because it would not promote a native plant community, and it would not improve conditions for soil stability and water runoff. In the riparian/floodplain, the impacts to water quality could be direct, long-term, minor to moderate, and adverse depending on whether the tamarisk community.

Soil Resources

Affected Environment

Soil erosion is a natural process (e.g., through precipitation, wind, and flood events); however, past human activities have affected soil erosion, compaction, depletion, soil type, and chemical composition. Some past activities that have compromised soil resources include archeological activities, energy development (e.g., roads and well pads), housing developments adjacent to the monument, agricultural activities, grazing, non-native species (possibly altering soil chemistry), soil amendments, and fertilizers.

It is likely that prior to grazing and other human activities, crypto-biotic soil crusts existed in some locations within the monument boundaries. Crypto-biotic soil crusts are found throughout the world and in many arid climates may account for up to 70% of the soil cover (Shepherd et al. 2002), although they are presently threatened in the arid western United States (Brantley and Shepherd 2004, Shepherd et al. 2002). These crypto-biotic soil crusts appear to serve similar ecological functions as litter by increasing biological diversity, increasing soil fertility, and enhancing seed germination (Belnap 1995, Shepherd et al. 2002). Crypto-biotic soil crusts are also thought to stabilize soils by decreasing erosion (Belnap 1995, Terry and Burns 1987). It is likely that these crypto-biotic soil crusts existed throughout the uplands and slopes before cattle grazing.

This impact topic has been retained because greater than minor impacts to soils are expected, on a short-term basis, from restoration activities in the future, including, removal of non-native plants, restoration of a native plant community, changes in use of irrigation water, fire, and other restoration activities that require movement of soil.

Intensity Level Definitions

To analyze the impacts on soil resources, the Monument used research, scientific literature, site specific soil resource inventory (See web links section in references), hydrology study, vegetation surveys, wildlife surveys, other park plans, professional judgments and monument staff insights, public input, and consultation with other permitting agencies. Soil resources can be affected by changes in habitat features, including changes in the plant community and subsequent use of vegetation by wildlife communities, as well as archeology activities and restoration activities and removal and/or control of invasive plants. According to the National Park Service's Management Policies (2006), the National Park Service would strive to preserve fundamental physical and biological processes, as well as individual species, features, and plant and animal communities. Furthermore, the National Park Service would prevent, to the extent feasible, unnatural erosion, depletion, and contamination of soil resources. The Service would try to maintain all the components and processes of naturally evolving park ecosystems, including the natural abundance, diversity, and genetic and ecological integrity of the plant species native to those ecosystems. Just as all components of a natural system would be recognized as important, natural change would also be recognized as an integral part of the functioning of natural systems. For the purposes of analyzing potential impacts, the intensity thresholds are as follows:

Negligible: Impacts would have no measurable or perceptible changes in soil resources – either quantity or quality.

Minor: Impacts would be measurable or perceptible but would be localized within a relatively small area. The overall quantity or quality of soil would not be affected and, if left alone, would recover.

Moderate: Impacts would cause a change in either quantity or quality of soil; however, the impact would remain localized.

Major: Impacts to either quantity or quality of soil would be substantial, highly noticeable, and permanent.

Impacts of Alternative 1 – No Action

Soils would continue to erode through natural processes (e.g., rain and other weather events) and human disturbances, including gas well and utilities maintenance and ditch maintenance for all vegetation management zones. Colonization by prairie dogs would continue to have a localized direct, short-term, minor, adverse impact on soils for archeological resources through soil mixing. Prairie dog soil mixing can have a localized direct, short-term, minor, beneficial impact for other biotic organisms (Davis and Theimer 2003, Whicker and Detling 1988). In the management zones with a high proportion of non-native species, allopathic chemicals and soil nutrient additions produced by non-native plants could result in unfavorable conditions for native plants (Blank 2008).

In general, disturbances to soil resources would be less noticeable in management zones, such as the uplands and slopes, which have been less impacted by natural and human disturbances. Cryptobiotic soil crusts are expected to reform in the uplands and slopes over time without human disturbances (Eldridge 2000).

In the Core Cultural Area, visitors mostly use paved trails; therefore, the few visitors walking off trail would have a negligible impact on soil resources (Nepal and Nepal 2004). Mechanical thinning for fuels reduction would have a direct, short-term, minor, adverse impact from workers thinning and clearing plant material (Pierson et al. 2007a). Non-local soils brought in as stockpiles for preservation work and used for mortar and backfill would have indirect, long-term, minor, adverse impacts on native soils (Korb et al. 2004).

In the riparian zone, soils would continue to erode from natural processes as well as from past and future activities of humans both upstream and downstream of the Monument (Lei 2008). It is not known what the future proportion of Russian olive to tamarisk would be without restoration treatments, but if tamarisk increases in abundance, the soils would increase in salt over time as tamarisk plants take up salts and deposit them on the soil through their leaves (Bagstad et al. 2006). The no-action alternative may have a direct, long-term, minor to moderate, adverse impact on riparian and floodplain soils.

In the Farmers Ditch zone, soils would continue to erode from natural processes as well as from past and future activities of humans upstream of the Monument and ditch maintenance (Lei 2008). Human activities, such as ditch maintenance, would have a localized direct, long-term, minor, adverse impact due to soil disturbance and erosion.

Cumulative impacts: Soil disturbance from human activities would have direct, long-term, minor, adverse impacts. Mitigation efforts to decrease soil disturbance, erosion, and bioturbation would minimize these impacts. The presence of some non-native plant species would have direct, long-term, minor, adverse effects by altering soil chemistry.

Conclusion: The overall impacts to soil for all vegetation zones would be direct, long-term, minor, and adverse due to erosion through natural processes and human disturbances.

Impacts of Alternative 2 – Proactive Vegetation/Cultural Landscape Management

Soils would continue to erode through natural processes (e.g., rain and other weather events) and human disturbances, including gas well and utilities maintenance and ditch maintenance for all vegetation management zones. In general, disturbances to soil resources would be less noticeable in management zones, such as the uplands and slopes, which have been less impacted by natural and human disturbances and have fewer non-native plant species in need of removal treatments. Augmentation of native species through replanting, seeding, and irrigation in all units would have direct, short-term, minor, adverse impacts due to soil disturbance associated with replanting and seeding but would have an

indirect, long-term, moderate, beneficial impact due to decreased soil erosion with establishment of native species (Bestelmeyer et al. 2006, Pierson et al. 2007b).

Native vegetation restoration, including soil augmentation, in areas such as the old fields/cultivated lands, and orchards would have an indirect, long-term, negligible/minor, beneficial impact on soil chemistry because native species are more compatible with native soils (Ehrenfeld 2004). Management actions to actively restore more natural conditions to provoke Prehistoric Landscape (e.g., regrade pushpiles, roads, well pads and other topographic features, cleaning up remaining homesite remains, and other soil disturbance activities) would have a direct, short-term, moderate, adverse impact due to increased soil disturbance. However, long-term these management activities to provoke the Prehistoric Landscape would have an indirect, minor to moderate, beneficial impact because of the decrease in soil erosion from established native vegetation (Bestelmeyer et al. 2006). Cryptobiotic soil crusts are expected to reform in the uplands and slopes over time without human disturbances (Eldridge 2000).

In the old fields/cultivated lands, the use of vegetative barriers to manage prairie dog colonies would have an indirect, long-term, moderate, beneficial impact because over time it would decrease soil disturbance and thus soil erosion (Davis and Theimer 2003). The use of goats would initially have a short term, minor, adverse impact on the soils, in localized areas, where used. This cultural tool will result in the removal of non-native plants, thereby allowing native plants to populate the area, which will result in long-term, minor, beneficial impacts.

In the Core Cultural Area, aggressive revegetation on steep slopes of ruin mounds would have a direct, long-term, minor, beneficial impact because it would decrease soil erosion. The removal of the tailwater drainage pipe and subsequent recontouring in the Core Cultural Area would have a direct, short-term, moderate, adverse impact because of increased soil disturbance. In the long term, following establishment of native plants this management action would result in an indirect, long-term, minor, beneficial impact due to decrease soil erosion. Elm tree control would consist of stumps being treated chemically, therefore, eliminating future control of elm resprouts and decreasing soil erosion. Similarly, chemical treatments to decrease and remove undesirable vegetation in Core Cultural Area would decrease fuel reduction treatments over time and, thus, have an indirect, long-term, minor, beneficial impact due to decreased soil disturbance from fuel treatments.

In riparian areas the removal of tamarisk would decrease salt uptake because tamarisk plants take up salts and deposit them on the soil through their leaves (Bagstad et al. 2006). The decrease in tamarisk would have a direct, long-term, minor to moderate, beneficial impact on soil chemistry (Taylor et al. 2006). The removal of Russian olive would also assist in restoring native soil chemistry (DeCant 2008). Chipping of undesirable non-native tamarisk and Russian olive would be beneficial for soil stabilization and would result in a short-term nutrient pulse, which is not natural but could provide beneficial effects to new vegetation and decrease soil erosion (Stoddard et al. 2008).

In the farmers ditch and other vegetation management zones, chemical use to eradicate non-native vegetation would have direct, short-term, moderate, adverse effects on native soil chemistry (Lair and Redente 2004, Perkins and McDaniel 2005). Burning or removing excess vegetation along the ditch would have direct, short-term, moderate, adverse impacts on soil erosion that would require mitigation to stabilize ditch banks (White et al. 2006). Prescribed fire in other vegetation management zones would have similar direct, short-term, moderate, adverse impacts on soil erosion (Rau et al. 2008). The removal of sod grass would have direct, short-term, minor, adverse impacts because of soil disturbance. Long term, removal of sod grass would have an indirect, minor beneficial impact because of the establishment of native vegetation and associated changes to soil chemistry.

Cumulative impacts: Soil disturbance from human activities would have direct, long-term, minor to moderate, beneficial effects. Mitigation efforts to decrease soil disturbance, erosion, and bioturbation would minimize these impacts.

Conclusion: The overall impacts to soil for all vegetation zones would be direct, long-term, minor to moderate, and beneficial, with moderate impacts occurring in vegetation zones that are more disturbed, such as the old fields/cultivated lands and riparian/floodplain, due to decreased soil erosion through the establishment of native vegetation and associated changes to soil chemistry.

Impacts of Alternative 3 – Limited Vegetation/Cultural Landscape Management

The impacts of Alternative 3 are similar to Alternative 2 except the augmentation of native species through replanting and seeding would only have a minor, not moderate, direct, long-term, beneficial impact because non-native vegetation would be treated using non-chemical alternatives only. This would result in some non-native species persisting, thereby, resulting in less decrease in soil erosion from establishment of a native vegetation community. The lack of chemical treatments would have a direct, short-term, minor, beneficial impact on native soil chemistry.

Soils would continue to erode through natural processes (e.g., rain and other weather events) and human disturbances, including gas well and utilities maintenance and ditch maintenance for all vegetation management zones.

In the uplands and slopes, not removing or recontouring recent features, such as pushpiles, well pad, gas line routes, would have a direct, short-term, moderate, beneficial impact because it would not disturb soils. However, long term, the lack of active vegetation restoration of well pads, roads, and homesites would have indirect, minor, adverse impacts because of the continued presence of non-native species associated with these features and the expectation that non-natives would increase in abundance in these areas affecting native soil chemistry and the ability to restore native vegetation and native soils (Bestelmeyer et al. 2006, Pierson et al. 2007b).
In the old fields/cultivated lands, planting shrubs with no large-scale native revegetation to manage prairie dog colonies would have a direct, long-term, minor, beneficial impact because it would over time decrease soil disturbance and, thus, soil erosion (Davis and Theimer 2003).

In the Core Cultural Area, elm tree control would consist of stumps being cut without chemical treatments and, therefore, future mechanical control of elm resprouts is needed, which would increase soil erosion (Pierson et al. 2007a). Similarly, the lack of chemical treatments to decrease and remove undesirable vegetation in Core Cultural Area would increase fuel reduction treatments over time and, thus, have a direct, long-term, minor, adverse impact due to increased soil disturbance from fuel treatments (Rau et al. 2008).

In the riparian zone, removal of Russian olive and tamarisk without chemicals would be ineffectual, and tamarisk would continue taking up salts and depositing them on the soil through their leaves. The persistence of tamarisk and Russian olive would have a direct, long-term, minor to moderate, adverse impact on soil chemistry (DeCant 2008, Taylor et al. 2006).

Cumulative impacts: Soil disturbance from human activities would have direct, long-term, minor to moderate, effects. Mitigation efforts to decrease soil disturbance, erosion, and bioturbation would minimize these impacts.

Conclusion: The overall impacts to soil for all vegetation zones would be direct, long-term, minor, and beneficial due to decreased soil erosion through establishment of native vegetation and associated changes to soil chemistry. Impacts would not include moderate beneficial changes because not all non-native species would be controlled due to chemical treatments not being included in this alternative.

Riparian Zone and Floodplain

Affected Environment

The riparian area consists of approximately 1,160 linear meters (0.72 miles) and 20 acres along the Animas River. The southern portion of the property has a clearly defined flood plain, but in the northern half of the property, the riverbanks are eroded up to 3 meters. The riparian zone is dominated by non-native invasive Russian olive and to a lesser degree by tamarisk. A total of at least 33 non-native plant species have been identified in the riparian zone (Korb 2008).

Numerous willows (*Salix* spp., some of which have been identified as *Salix gooddingii* × *rubens*), and cottonwoods persist among the Russian olive and tamarisk trees. Willows and cottonwoods are more common in the southern portion where there is a clearly defined floodplain (Fig. 2). Across the Animas River, conditions are similar to conditions within the Monument boundary. Upstream and downstream, also have heavy infestations of Russian olive and tamarisk.

Although it is a relatively rare resource, covering a small percent of land surface, riparian areas provide important resources to both humans and wildlife. Riparian areas in healthy, functioning condition generally support lush vegetation and food resources to support a diversity of wildlife, including threatened and endangered species. Many species depend on riparian areas for all or part of their life cycles. For example, in the arid southwestern United States, at least 77% of 166 nesting bird species are associated with riparian habitat, and 50% of nesting bird species are completely dependent on riparian ecosystems (Johnson et al. 1977). No structures, other than a few building remnants occur on the floodplains or riparian areas; therefore, other than additional potential bank erosion, flooding from the Animas River is of minimal concern.

Intensity Level Definitions

To analyze the impacts on the riparian zone and floodplain, the Monument used research, scientific literature, site-specific hydrology study, soil inventory, vegetation surveys, wildlife surveys, other park plans, professional judgments and monument staff insights, public input, and consultation with other permitting agencies. Riparian zones and floodplains can be threatened by changes in hydrology, soils, and vegetation as well as activities upstream and downstream. According to the National Park Service's Management Policies (2006), the National Park Service would strive to preserve fundamental physical and biological processes, as well as individual species, features, and plant and animal communities. The Service would try to maintain all the components and processes of naturally evolving park ecosystems, including the natural abundance, diversity, and genetic and ecological integrity of the plant species native to those ecosystems. Just as all components of a natural system would be recognized as important, natural change would also be recognized as an integral part of the functioning of natural systems. For the purposes of analyzing potential impacts, the intensity thresholds are as follows:

Negligible: Impacts would have no measurable or perceptible changes in the integrity or functioning condition of the riparian zone and floodplain.

Minor: Impacts would be measurable or perceptible but would be localized within a relatively small area. The overall integrity or functioning condition of the riparian zone and floodplain would not be affected and, if left alone, would recover.

Moderate: Impacts would cause a change in the integrity or functioning condition of the riparian zone and floodplain; however, the impact would remain localized.

Major: Impacts to the riparian zone and floodplain would be substantial, highly noticeable, and relatively permanent. The integrity and functioning condition of riparian zone and floodplain would be compromised, and upstream and/or downstream conditions could be measurably affected.

Impacts of Alternative 1 – No Action

No action would have a long-term moderate adverse impact on the riparian plant community. No action would most likely result in further dominance by the invasive non-native Russian olive and tamarisk community and would, therefore, result in further loss of plant diversity (Di Tomosa1998, Frasier and Johnsen 1991, Levine et al. 2003, Glenn and Nagler 2005) and a decrease in aquatic macroinvertebrates (Bailey et al. 2001) and other ecological functions (Engel-Wilson and Ohmart 1978, Hunter et al. 1988, Ohmart et al. 1988, Zavaketa 2000). Without action, it is not known what the composition of the Russian olive and tamarisk community would be. However, in other locations, dense stands of tamarisk have significantly reduced germination sites that are suitable for establishment of native cottonwoods (Howe and Knopf 1991). If tamarisk eventually dominates, it could also have direct, long-term, moderate, adverse impacts on the floodplain because tamarisk plants tend to eliminate the riparian forbs and grasses that have root masses that can withstand the energy of water during high flows and prevent soil erosion (Prichard 1998).

Cumulative impacts: The no action alternative would likely result in an increase of Russian olive and tamarisk and contribute to the spread of these plants throughout the region where efforts are underway to restore riparian floodplains. This may result in direct, long-term, moderate, adverse impacts throughout the region. Conversely, if the surrounding community does not eradicate these woody invasive trees, it could, to an unknown degree, hamper efforts at the Monument.

Conclusion: No action to restore the native plant community in the riparian zone would most likely result in continued increase of non-native plants and decrease of native plants, which could result in compromised proper functioning condition of the riparian zone and floodplain, resulting in direct, long-term, moderate, adverse impacts.

Impacts of Alternative 2 – Proactive Vegetation/Cultural Landscape Management

In the riparian area where banks are not eroded and water has access to the floodplain, eradication of Russian olive and tamarisk with chemicals that are appropriate for use near water and no replacement plantings of woody native plants would have direct, short-term and long-term, moderate, beneficial impacts. Willows and cottonwoods are scattered throughout this area, and it is expected that new recruits would thrive without competition from Russian olive and tamarisk trees. Demonstration areas upstream on the Animas River in Colorado with similar conditions before control of Russian olive resulted in rapid and positive response of cottonwoods, willows, and other riparian plants. Since this is a restoration of native vegetation, impacts associated with it are viewed as beneficial to floodplain processes and values therefore no further floodplain analysis is necessary.

The riparian area on the northern end of the Monument has eroded banks and would, therefore, require a different restoration approach than the southern end where there is a well-defined floodplain. In order to prevent further soil erosion, native trees and shrubs would need to be planted at the same time as the Russian olive and tamarisk trees are removed. Throughout the entire riparian area, the root structure of Russian olive and tamarisk, which would be left in place, would prevent further bank erosion while the root structure of the newly planted trees and shrubs and develop. Direct, short-term and long-term, moderate, beneficial impacts are expected from this method because it would promote a healthy, native community with greater diversity than currently exists.

Chemicals that are appropriate for use near water would be used to paint the stumps immediately after cutting and under the right conditions do not leave the root system (Hillmer and Liedtke 2003). These chemicals would have direct, short-term and long-term, moderate, beneficial impacts to the riparian zone because they would effectively eliminate the invasive non-natives, promote diversity, and increase the chances of restoration efforts.

The return of the riparian unit to a more natural scene would have direct minor beneficial effects to units whose vista include the riparian unit, such as historic, developed, and core cultural units. There would be no effect on the other units.

Cumulative impacts: Active control of Russian olive and tamarisk with concurrent restoration of the native riparian plant community would result in direct, short-term and long-term, moderate, beneficial impacts because it would promote a healthy, diverse native community. Additionally, control of Russian olive and tamarisk within the Monument would contribute to restoration goals outside the Monument and in the region because it would eliminate a significant seed source.

Conclusion: The overall impacts to the riparian/floodplain would be direct, long-term, minor to moderate, and beneficial because this alternative focuses on restoration and preservation of native plant communities, which provide more natural ecological processes.

Impacts of Alternative 3 – Limited Vegetation/Cultural Landscape Management

In the riparian area, eradication of Russian olive and tamarisk without chemicals would result in multiple resprouts from cut stumps and formation of dense thickets of both Russian olive and tamarisk. It may also result in elimination of riparian forbs and grasses that contribute to bank stabilization (Pollen-Bankhead et al. 2008), which would be more likely if tamarisk eventually out-competes Russian olive. This would potentially result in further deterioration of the riparian zone and, therefore, have direct, long-term, moderate, adverse impacts.

Cumulative impacts: Control of Russian olive and tamarisk is ineffective without the use of chemicals. It is expected that without chemical treatments, the riparian floodplain would become more heavily invaded by these trees and further contribute to the seed source within and outside the Monument. Therefore, the impacts would be direct, long-term, moderate, and adverse.

Conclusion: It is expected that without chemical treatments, the abundance of Russian olive and tamarisk would increase, resulting in direct, long-term, moderate, adverse impacts to the riparian/floodplain.

CONSULTATION AND COORDINATION

Internal Scoping

Scoping is a process that identifies the resources that may be affected by a project proposal and explores possible alternative ways of achieving the proposal while minimizing adverse impacts. Internal scoping was conducted by an interdisciplinary team of professionals from Aztec Ruins National Monument, Chaco Culture National Historic Park, Colorado Plateau Cooperative Ecosystems Studies Unit (CPCESU), and the National Park Service Intermountain Regional Office. Interdisciplinary team members met July 10-13, 2006, to (1) discuss the purpose and need for the project, (2) identify project objectives, (3) identify a range of reasonable alternatives, including mitigation measures, and (4) analyze potential environmental impacts. During this internal scoping meeting, the interdisciplinary team conducted a site visit to view the areas of concern within the Monument and to identify potential alternatives.

External Scoping

External scoping was conducted to inform the public about the proposal to implement a Vegetation Management and Cultural Landscape Preservation Maintenance Plan. The effort was initiated with the distribution of a scoping letter, a newspaper article, and an internet posting to inform the public, stakeholders, and agencies of the proposed Plan and to generate input on the preparation of this Plan/ Environmental Assessment. During the 30-day scoping period, from January 22, 2008 and February 22, 2008, three responses were received. One of the comments supported the proposal, while the other two expressed concern about chemical use within the archeological sites. No other comments were received during scoping.

Agency Consultation

In accordance with the Endangered Species Act, NPS contacted the U.S. Fish and Wildlife Service with regards to federally listed special status species and in accordance with National Park Service policy, the Monument also contacted the New Mexico Department of Game and Fish with regards to state-listed species. The results of this consultation are described in the Special Status Species section in the Impact Topics Retained for Further Analysis chapter.

In accordance with §106 of the National Historic Preservation Act, NPS provided the New Mexico State Historic Preservation Officer an opportunity to comment on the effects of this project. A letter from the New Mexico State Historic Preservation Officer, dated December 21, 2012 confirmed NPS's "no adverse effect" determination under §106 of the National Historic Preservation Act. The SHPO has asked, however, that their office be consulted if the Monument determines that a particular project covered under this plan will have a minor adverse impact.

Native American Consultation

26 Native American tribes were contacted at the beginning of this project to determine if they wanted to be involved in the environmental compliance process, including:

Ysleta del Sur; Southern Ute Tribe; Ute mountain Ute Tribe; Hopi Tribe; Navajo Nation; Pueblo of San Felipe; Pueblo of Sandia; Pueblo of Santa Ana; Pueblo of Jemez; Pueblo of Isleta; Pueblo of Laguna; Pueblo of Zia; Pueblo of Santo Domingo; Pueblo of Acoma; Pueblo of Cochiti; Pueblo of Zuni; Pueblo of Nambe; Pueblo of Tesuque; Pueblo of San Ildefonso; Pueblo of Pojoaque; Pueblo of Taos; Pueblo of Santa Clara; pueblo of Picuris; Ohkay Owingeh; Jicarilla Apache; Mescalero Apache.

We received comments from Hopi Tribe, Pueblo of Jemez, and Pueblo of Laguna. The Hopi Tribe and Pueblo of Jemez generally supports the plan, but questioned the use of chemical controls. The Hopi Tribe would like to receive a copy of the EA when it goes out for public comment. The Pueblo of Laguna does not believe the plan will have a significant impact.

Environmental Assessment Review and List of Recipients

The Vegetation Management and Cultural Landscape Preservation Maintenance Plan/Environmental Assessment would be released for public review on October 10, 2012. To inform the public of the availability of the Vegetation Management and Cultural Landscape Preservation Maintenance Plan/Environmental Assessment, the National Park Service would publish and distribute a letter or press release to various agencies, and members of the public on the Monument's mailing list, as well as place an ad in the local newspaper. Copies of the Vegetation Management and Cultural Landscape Preservation Maintenance Plan/Environmental Assessment would be provided to interested individuals, upon request. Copies of the document would also be available for review at the National Monument's visitor center and on the internet at the National Park Service Planning, Environment, and Public Comment website (See web links section in references).

The Vegetation Management and Cultural Landscape Preservation Maintenance Plan/Environmental Assessment is subject to a 30-day public comment period ending November 8, 2012. During this time, the public is encouraged to submit their written comments to the National Park Service address provided at the beginning of this document. Following the close of the comment period, all public comments would be reviewed and analyzed, prior to the release of a decision document. The National Park Service would issue responses to substantive comments received during the public comment period, and would make appropriate changes to the Vegetation Management and Cultural Landscape Preservation Maintenance Plan/Environmental Assessment, as needed.

List of Preparers

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National Park Service Planning, Environment, and Public Comment website
http://parkplanning.nps.gov/azru

Appendix A

Aztec Ruins National Monument Vegetation Management and Cultural Landscape Preservation Decision- Making Tree Overview

Identify Exotic Plants that Meet Action Thresholds

Establish management objectives. Identify exotic plants present within park unit. Then, identify those exotic plants whose management meets action thresholds.

Guidance for Setting Management Priorities

Use guidance to set exotic plant management priorities based on their potential impact on park resources and potential for control.

Confirm Compliance of Treatment Method with an Existing NEPA Document

Prior to implementing the selected treatment, confirm that the selected treatment method has the necessary compliance with NEPA.

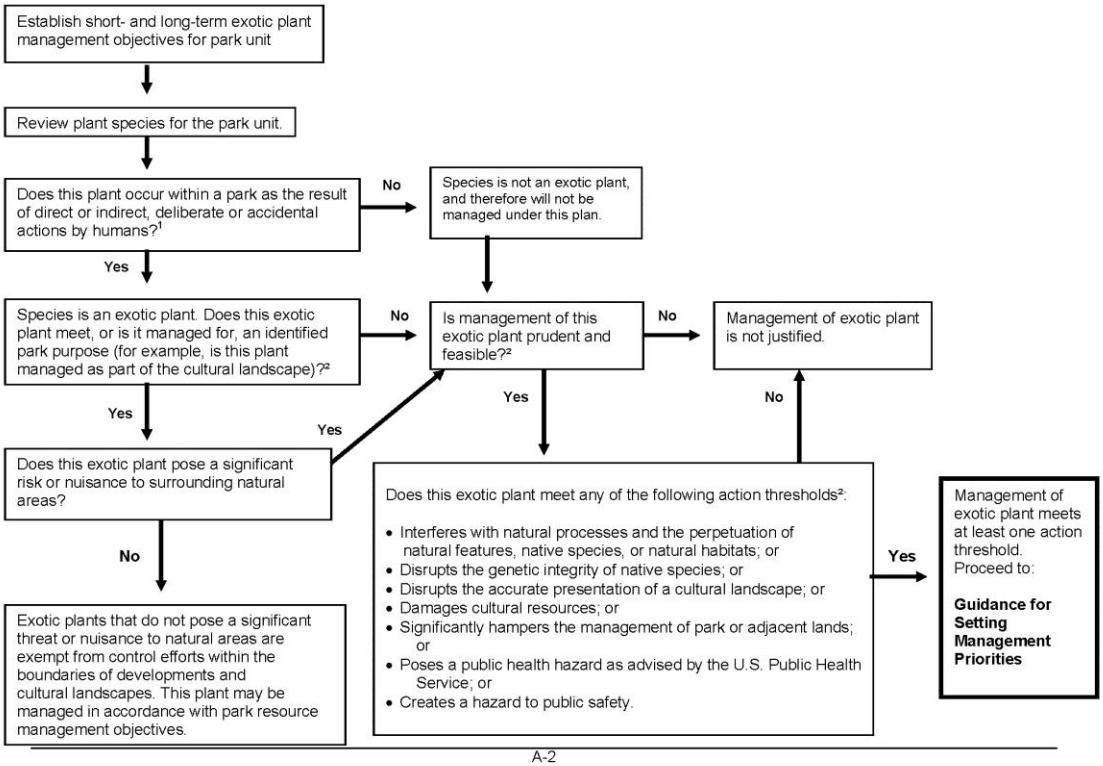
Optimum Tool Analysis for Treatment Options

Identify proposed treatment options for each priority exotic plant. For each proposed treatment option, evaluate whether alternative treatment options with fewer potential impacts could be used.

Confirm Compliance of Chemical and Biological Control Treatments with Applicable Regulations

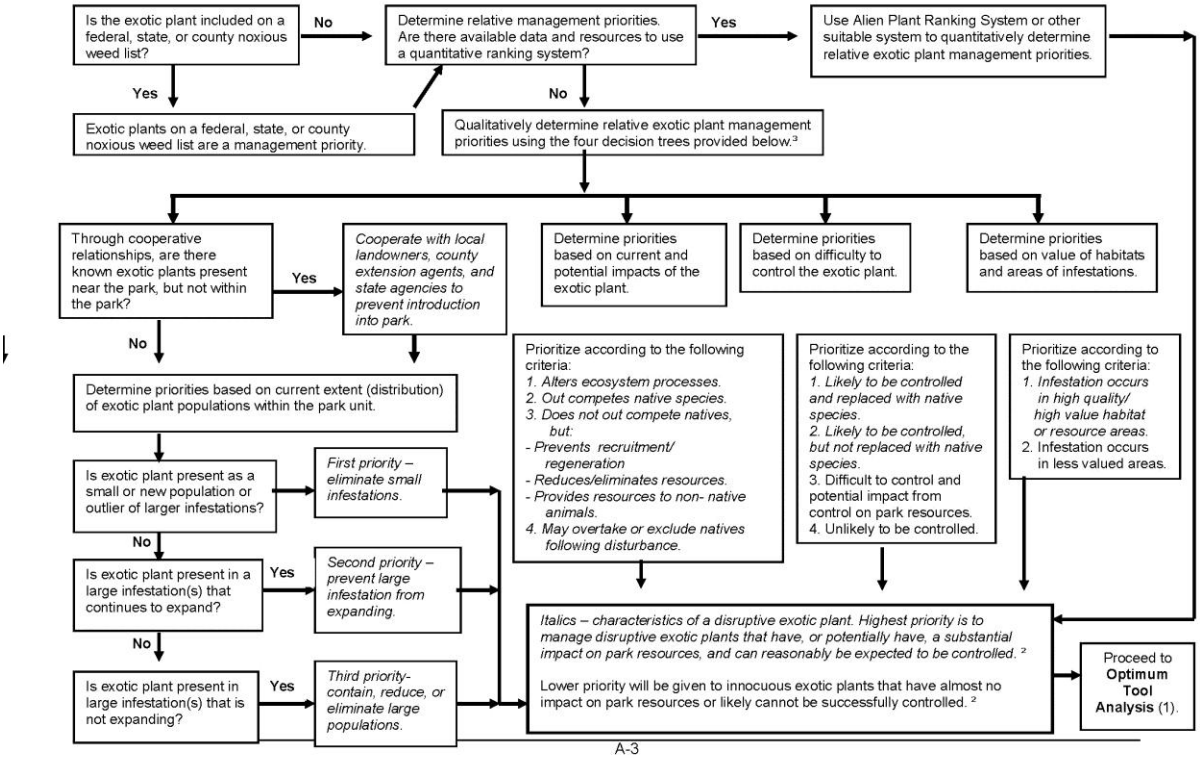
If chemical or biological treatments are selected, confirm that their use is compliant with applicable regulations and policies.

Identify Exotic Plants that Meet Action Thresholds



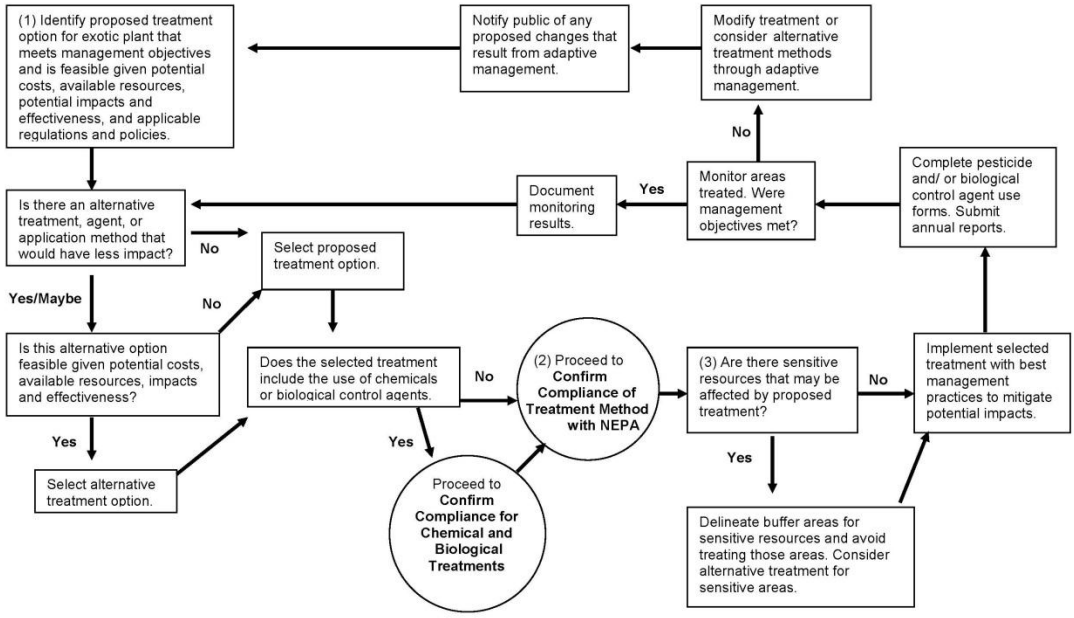
A-2

Guidance for Setting Management Priorities

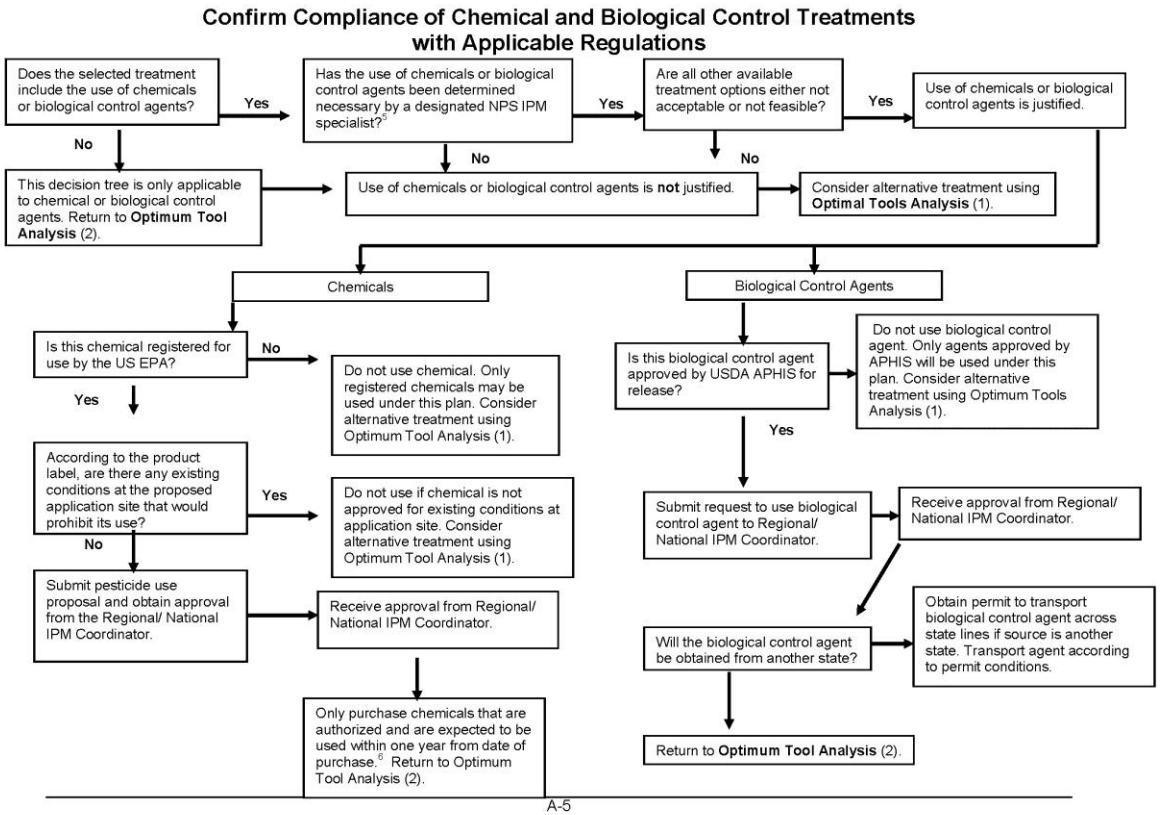


A-3

Optimum Tool Analysis for Treatment

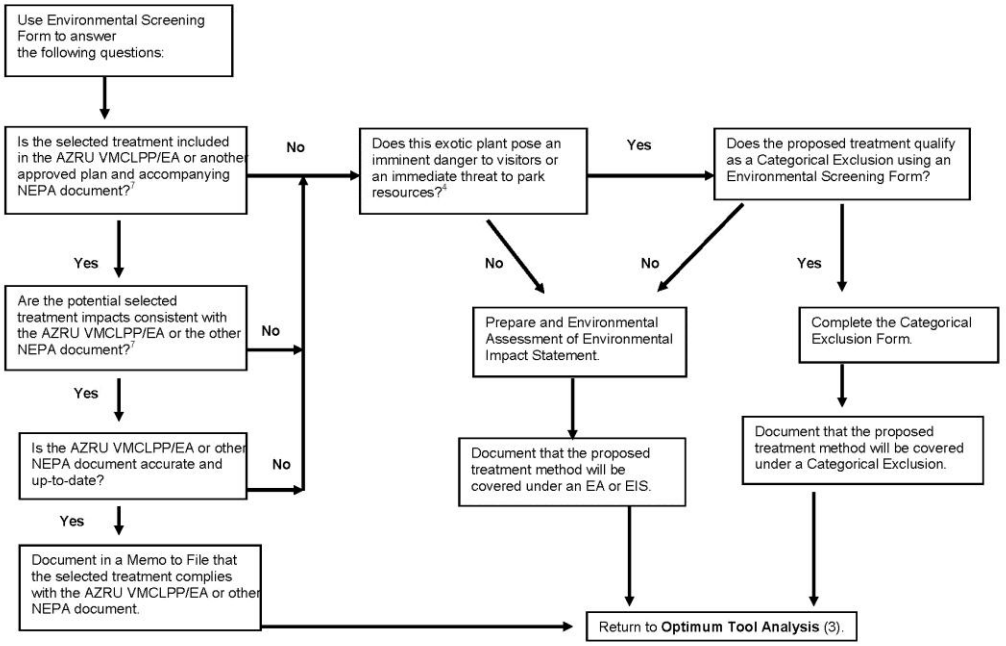


A-4


Confirm Compliance of Chemical and Biological Control Treatments with Applicable Regulations
Does the selected treatment include the use of chemicals or biological control agents?
Yes
No
Has the use of chemicals or biological control agents been determined necessary by a designated NPS IPM specialist?
Yes
No
Are all other available treatment options either not acceptable or not feasible?
Yes
No
Use of chemicals or biological control agents is justified.
This decision tree is only applicable to chemical or biological control agents. Return to Optimum Tool Analysis (2).
Use of chemicals or biological control agents is not justified.
Consider alternative treatment using Optimal Tools Analysis (1).
Chemicals
Biological Control Agents
Is this chemical registered for use by the US EPA?
No
Yes
Do not use chemical. Only registered chemicals may be used under this plan. Consider alternative treatment using Optimum Tool Analysis (1).
According to the product label, are there any existing conditions at the proposed application site that would prohibit its use?
Yes
No
Do not use if chemical is not approved for existing conditions at application site. Consider alternative treatment using Optimum Tool Analysis (1).
Submit pesticide use proposal and obtain approval from the Regional/ National IPM Coordinator.
Receive approval from Regional/ National IPM Coordinator.
Only purchase chemicals that are authorized and are expected to be used within one year from date of purchase.[6] Return to Optimum Tool Analysis (2).
Is this biological control agent approved by USDA APHIS for release?
Do not use biological control agent. Only agents approved by APHIS will be used under this plan. Consider alternative treatment using Optimum Tools Analysis (1).
Yes
Submit request to use biological control agent to Regional/ National IPM Coordinator.
Receive approval from Regional/ National IPM Coordinator.
Will the biological control agent be obtained from another state?
Obtain permit to transport biological control agent across state lines if source is another state. Transport agent according to permit conditions.
Return to Optimum Tool Analysis (2).

A-5

Confirm Compliance of Treatment Method with an Existing NEPA Document



Footnotes

1 National Park Service. 2006. Management Policies. Section 4.4.1.3.
2 National Park Service. Management Policies. 2006. Section 4.4.4.2.
3 Adapted from the Site Weed Management Plan for Middle Niobrara Weed Awareness Group, Middle Niobrara River Valley, Nebraska 2003- 2005 (Faulkenberry 2003) and Handbook for Ranking Exotic Plants for Management and Control (Hiebert and Stubbendieck 1993)
4 National Park Service. 2001. Director's Order #12. Conservation Planning, Environmental Impact Analysis, and Decision Making.
5 National Park Service. 2006. Management Policies. Section 4.4.5.3.
6 National Park Service. 2006. Management Policies. Section 4.4.5.5

APPENDIX B

Invasive Plant Management

Implementation of invasive plant species management activities at AZRU is important to the preservation , protection, and restoration of a more natural abundance, diversity and distribution of native species to ensure the most appropriate understanding by park visitors of both the natural and cultural landscapes associated with the parks primary resources.

Under the No Action Alternative (Alternative 1) there would be no pulling or spraying of invasive vegetation. Reseeding and planting to encourage the re-establishment of native plants and prevent the establishment of invasive vegetation would be minimal. The exception would be those treatment options that either qualifies as a Categorical Exclusion (CE) or whose impacts have been previously addressed in other NEPA documents. Under DO-12 (Conservation Planning, Environmental Impact Analysis, and Decision Making), the only non-native/invasive plant management activities that are covered under a CE involve " *removal of individual members of a non-threatening/endangered species or population of pests and exotic plants that pose an imminent danger to par visitors or are an immediate threat to park resources*". In addition, any activity undertaken under a CE must also have none to negligible measurable impacts to park resources. This is the current vegetation/cultural landscape management approach used at AZRU.

Alternatives 2 and 3 within this plan were designed to implement more appropriate actions for invasive plant management as mandated in NPS Management Policies (2006) and in the NPS Director's Order 77-7-Integrated Pest Management (IPM). Alternative 2 is the most proactive, responsible, and adaptive of the three alternatives and would allow for a more integrated approach to invasive species management. Alternative 3 would allow for all activities as identified in Alternative 2, but would not allow for the use of chemical treatments of weed populations.

Although Alternative 3 would provide beneficial management of park vegetation and cultural landscape resources, it would not allow for the most effective management of weed species that can only be controlled through chemical use. Most distinctly, alternative 3 would limit the ability of the park to restore certain habitats and/or limit the maximum protection of archeological resources. The most notable examples are restoration of the riparian corridor, where tamarisk and Russian olive require both mechanical (cutting) and chemical treatment to the cut stumps to kill the invasive trees. Cutting alone would only result in the re-sprouting of these species. Many of the non-native pasture grasses in the old agricultural fields and picnic area would also most likely require chemical treatment to insure the killing of sod forming and/or rhizomatous non-native grass species that would prohibit any effective native species restoration without full control. In addition, the use of mechanical removal of weed species typically results in greater ground disturbance which places buried archeological resources more at risk of unintended impacts.

Key components for invasive species management for AZRU are also going to require:

- **Prioritization** of non-native species to identify those species that are most likely to adversely impact park resources or that are highly aggressive in their reproductive and establishment abilities (i.e. State and Federally Listed Noxious Weeds).
- **Appropriate Treatment** of weed species would be based on the most appropriate and effective treatment to ensure effective control, containment, or complete eradication of identified priority non-native weeds species. Potential treatment types may include: Manual Control, Chemical Control, Use of Prescribed Fire, Cultural Controls, and /or use of Biological Controls. Each of these treatment types are explained in more detail below in this document.
- **Monitoring** of weed locations and treatment sites is critical to maintaining effective control over treated weed populations and to identify early the potential establishment of new weed infestations.
- **Establish Partnerships and Cooperative Efforts with Park Neighbors** is critical to maintaining healthy vegetation communities. Invasive species are not confined by artificially defined boundaries and management activities to control invasive species are most effective if applied across a larger landscape.

All alternatives proposed in this plan and associated Environmental Assessment would use, to the greatest extent possible, an adaptive management approach to invasive plant management. The adaptive, integrated approach is defined as a system for the planning and implementation of a program using an interdisciplinary approach, to select the appropriate method for containing or controlling an undesirable plant species, or groups of species, using all available "tools" that may be most effective in creating a desired outcome(s).
Table X gives a general overview of invasive plant and restoration abilities and constraints and well as a description of how well each alternative meets park vegetation and cultural landscape management goals. Each of the alternatives would provide some level on invasive plant and cultural landscape management. However, the ability to use the adaptive, integrated approach is distinctly limited under Alternative 1 and this would prevent the park form fully meeting vegetation and cultural landscape management objectives identified for the park.

Table X. Ability of Alternatives to Meet the Vegetation and Cultural Landscape Management Plan Objectives

Alternative 1: No Action Under this alternative vegetation/cultural landscape management activities would be limited. No invasive plant treatments or restoration activities would occur except for already existing treatments that have been approved in other NEPA documents (Protection of Cultural Ruins). No comprehensive plant management program would be developed. **Meets Project Objectives:** No. Invasive plant infestations would be expected to expand under this alternative, further distracting from appropriate understanding of the site by park visitors. The No Action alternative does not provide the tools necessary for the preservation, protection and restoration of native plant communities and associated cultural landscapes. No formal procedures would be in place to direct restoration activities, monitor invasive species, or to prevent further introduction of invasive plants. Alternative 1 does not meet plan objectives.
Alternative 2: Full Proactive Vegetation and Cultural Landscape Management Under this alternative the full range of vegetation management and Integrated Pest Management (IPM) techniques and tools would be used, including mechanical, prescribed fire, chemical, and biological control of non-native/invasive species and the implementation of a comprehensive restoration program for disturbed lands within the park. This alternative would also provide a full range of opportunities to mitigate impacts and preserve identified park cultural landscapes. **Meets Project Objectives:** Yes. The maximum amount and type of desired vegetation and cultural landscape resource conditions would be preserved, protected or restored over the long-term through the implementation of a comprehensive, proactive vegetation/cultural landscape management plan. Alternative 2 would fully meet plan objectives.
Alternative 3: Limited Vegetation and Cultural Landscape Management Under this alternative a some of the invasive vegetation and IPM techniques would be employed with the exception of chemical (e.g. herbicide) use. This alternative would also not include any ***active*** restoration activities for natural or cultural landscapes, but instead would rely on passive restoration efforts to revegetate disturbed land areas. **Meets Project Objective:** Partially. This alternative would allow for non-chemical control of invasive weed species, but many of the species on the site are next to impossible to control without some chemical use. Although there would be some restoration due to the removals of non-contributing structures/vegetation, full restoration objectives would not be met, resulting in a high probability of the same or other invasive weeds establishing in areas of disturbance. Alternative 3 would partially meet some plan objectives but, would also continue to contribute to the continuation of some of the existing undesired natural and cultural landscape conditions.

The use of IPM guidelines for the effective management of invasive plants includes selecting the best "tool" or "set of tools" to ensure effective invasive plant control while at the same time minimizing risks to humans and natural and cultural resources. The five types of control measures used for the management of invasive plant species are identified below. In addition, Table XX identifies the most dominant invasive plant species found within each management unit of the park along with the most appropriate set of IPM tools needed to effectively control the identified priority weed species.

A. Mechanical Control

Mechanical techniques for control of invasive plants in AZRU include mowing, cutting/sawing, digging, pulling, spudding (severing of roots below the root crown), discing/plowing, and smothering. Mechanical techniques can be especially effective in preventing seed production in annual and biennial forbs and in exhausting root reserves in perennial plants (Meunscher 1980). Timing of these controls can be extremely important in determining outcome.
For species that reproduce vegetatively from root parts (such as tamarisk), mechanical treatments are generally not expected to provide complete control, even when repeated. Most often, they can be used as a tool for stressing the plants to make other treatments more effective (Derscheid et al. 1961, Renz and DiTomaso 1998)

B. Cultural Control

Cultural control of non-native weed species involves establishing a set of "best management practices" whenever there is ground disturbance. Implementation of "Best Management Practices" as identified in the below table (Table XX) would aid in the prevention and early detection of new weed introductions and that would assist in minimizing spread of existing weed populations. Additionally, planted non-native tree species (e.g. Siberian elm and) and even some native shrub (e.g. Greasewood) that are unnaturally high in densities or outside their natural range of occurrence, would be reduced to restore a more open appropriate appearance to the parks identified natural and cultural landscapes.

Table XX. Preventative "Best Management Practices" (Cultural Practices) Proposed for use at Aztec Ruins National Monument

Weed-Free Materials	• All revegetation/restoration projects at the park would use weed-free topsoil, seed, and mulch materials. All monitored grazing activities would require feeding of weed-free hay for a minimum of 7 days prior to livestock use within the NHS. This would eliminate the potential for additional introductions of non-native weed species by livestock.
Approved Native Seed Mixtures Only	• All seed mixtures used for revegetation/restoration activities would be based on native genotypes from as local of source as is possible. All seed mixtures must be appropriately certified (tagged) and would be inspected (to ensure appropriate mixture and absence of weed seed) prior to planting by park resources management staff.
Sterile Mulch or Native Grass Mulch	• All straw/grass mulches and/or organic forms of erosion control used at the park would be certified weed-free.
Appropriately Timed Mowing	• The park would mow all visitor use areas and trails based on timing that prevents mowing during seed set by identified weed species to prevent further spread
Follow-up Weed Monitoring/ Control	• Annual follow-up monitoring for weed presences of all revegetated/restored areas would be conducted for a minimum of three years following completions of revegetation activities.
Immediate Eradication of New Species	• Any new noxious weed species found on site would be controlled/eradicated immediately to prevent further spread.
Prohibition of Undesirable Species	• No non-native plant species with potential for spread would be introduced into park landscaping as per NPS Management Policies (2006).

C. Fire

Fire has a significant impact on vegetation by influencing nutrient cycling, water availability, plant composition and diversity, and reduces fuel accumulation. Prescribed burning consists of planning, setting, and managing fire to accomplish resource management objectives (CNAP 2000). Fire is necessary to prompt germination of some plants, but it can also reduce the abundance of some species. The most successful uses of fire for invasive species control result

from burns that try to mimic or restore historical (natural) fire regimes, which have been disrupted by land use changes, suppression practices, fire breaks, or development (Tu et al. 2001).

D. Chemical Control

Chemical control refers to the use of herbicides to kill or injure target plants, as well as chemicals applied along with herbicides that improve their efficacy (adjuvants). Chemical treatments include the use of a number of recommended herbicides including both pre- and post-emergent herbicides. Additional herbicides may be used, including known herbicides found to be effective on additional species and herbicides that may be developed in the future. Other herbicides that would be considered for use are the relatively new 'smart herbicides' such as Habitat® that provide 'intelligent', long-term vegetation control by affecting enzymes found only in plants – not in birds, mammals, fish, insects or humans. Habitat® breaks down quickly in water, allowing desirable vegetation to germinate and repopulate a treated site. Because it is considered a low volume herbicide, it provides more control with less chemical load on the environment, compared to other herbicides. Most herbicides would be applied in the park using backpack sprayers. Table XXX provides a list of the most likely herbicides to be used at AZRU.

E. Biological Control

Biological control can be defined as the deliberate introduction or manipulation of an invasive plant's natural enemies (e.g. insects and pathogens) with the goal of suppressing the invasive population (Wilson and Huffaker 1976). The theoretical framework for the use of biological controls is based on the hypothesis that the success of many non-native invasive plants is the result of their release from predators or pathogens found in their native range when introduced in a new range (Cronk and Fuller 1995). By introducing predators or pathogens, usually from the invasive plants' native range, their success can be curbed, allowing native plants to compete on more equal terms. Bio-control agents are not capable of completely eradicating an invasive plant population, because as the number of host plants declines, so does the population of bio-control agents. However, bio-control can be a useful tool in reducing the initial size or density of an invasive plant infestation, making other treatments more efficacious.

At this time this type of biological control of invasive species found at AZRU is not being used. The literature has been reviewed for information on biological control agents for a number of the invasive species known to occur at AZRU. If a decision to use biological control is identified as necessary it is most likely that this method of control would be limited to two species: Tamarisk in which a leaf beetle (*Diorhabda elongate*) from central Asia is being used for biological control and for field bindweed (*Convolvulus arvensis*) in which a microscopic mite (*Aceria malherbae)* has been imported from southern Europe has proven effective with bindweed control.

AZRU is also proposing a second form of biological control to assist with invasive weed management. Both Alternative 2 and Alternative 3 would allow for the use of goats and a targeted prescribed grazing assisting with weed management. This treatment type would likely be most effective when applied appropriately to targeted weed species and timed to minimize goat grazing impacts to more palatable native species.

Table XXX. Inventory of Invasive Plants at AZRU by Management Unit

Park Management Unit	Dominant Weeds Species Present	Scientific Name	IPM Tools to be Used in Each Management Unit
Upland and Slopes	Filaree Cheatgrass Tumblemustard	*Erodium cicutarium* *Bromus tectorum* *Sisymbrium altissimum*	Mechanical and Chemical
Oldfield and Cultivated Lands (including	Common Kochia Cheatgrass	*Kochia scoparia* *Bromus tectorum*	Mechanical, Chemical, and Cultural

Orchards)	Smooth Brome Russian Thistle Intermediate Wheat Siberian Elm Meadow Foxtail Timothy grass Orchard grass Hoary cress Perennial pepperweed	*Bromus inermis* *Salsola tragus* *Thinopyrum intermedium* *Ulmus pumila* *Alopecurus pratensis* *Phleum pratensis* *Dactylis glomerata* *Cardaria draba* *Lepidium latifolium*	
Core Cultural Area	Common Kochia Cheatgrass	*Kochia scoparia* *Bromus tectorum*	Mechanical and Chemical
Riparian and Floodplain	Russian Olive Tamarisk Smooth Brome Musk Thistle Canadian Thistle Meadow Foxtail	*Elaeagnus angustifolia* *Tamarix spp.* *Bromis inermis* *Carduus nutans* *Circium arvense* *Alopecurus pratensis*	Mechanical, Chemical, Cultural, and Biological
Farmers Ditch	Common Kochia Russian thistle Tumble mustard Cheatgrass Russian Olive Scotch thistle Hoary cress Russian knapweed	*Kochia scoparia* *Salsola tragus* *Sisymbrium altissimum* *Bromus tectorum* *Elaeagnus angustifolia* *Onopordum acanthium* *Cardaria draba*	Mechanical, Chemical, and Cultural
Historic District	Common Kochia Cheatgrass Smooth Brome Siberian Elm	*Kochia scoparia* *Bromus tectorum* *Bromus inermis* *Ulmus pumila*	Mechanical and Chemical

Table XXXX. Herbicides (Chemicals) That May be Used to Control Invasive Plants at AZRU

Herbicide	Trade Name
glyphosate	Round-Up® or Rodeo®
2,4-D	Invasive Plantone® or Aqua-Kleen®
clopyralid	Transline®
dicambia	Clarity®, Banvel®
imazapic	Plateau®, Cadre®
imazapyr	Habitat®
triclopyr	Garlom3A or 4®, or Access®

The Material Safety Data Sheets (MSDS) for each proposed herbicide identified in the above table can be found in Appendix C of this document.

APPENDIX C
Material Data Safety Sheets

CHEM SERVICE INC -- PS-356 DICAMBA/BANVEL (TM) 99% -- 6810-00F018380

========== Product Identification ==========

Product ID:PS-356 DICAMBA/BANVEL (TM) 99%
MSDS Date:07/10/1990
FSC:6810
NIIN:00F018380
MSDS Number: BKXTY
=== Responsible Party ===
Company Name:CHEM SERVICE INC
Box:3108
City:WEST CHESTER
State:PA
ZIP:19381
Info Phone Num:(215) 692-3026
Emergency Phone Num:(215) 386-2100
CAGE:84898
=== Contractor Identification ===
Company Name:CHEM SERVICE INC
Box:3108
City:WEST CHESTER
State:PA
ZIP:19381
Country:US
Phone:215-692-3026
CAGE:84898
Company Name:CHEM SERVICE, INC
Address:660 TOWER LN
Box:599
City:WEST CHESTER
State:PA
ZIP:19301-9650
Country:US
Phone:610-692-3026
CAGE:8Y898

========== Composition/Information on Ingredients ==========

Ingred Name:DICAMBA (SARA III)
CAS:1918-00-9
RTECS #:DG7525000
Fraction by Wt: 99%
EPA Rpt Qty:1000 LBS
DOT Rpt Qty:1000 LBS

========== Hazards Identification ==========

LD50 LC50 Mixture:LD50 (RAT OR MOUSE): 1040 MG/KG.
Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES
Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO
Health Hazards Acute and Chronic:SKIN: IRRITATION & HARMFUL IF

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    ABSORBED. INHALATION: MUCOUS MEMBRANE IRRITATION & HARMFUL.
    INGESTION: HARMFUL.
Explanation of Carcinogenicity:NONE
Effects of Overexposure:SKIN: IRRITATION & HARMFUL IF ABSORBED.
    INHALATION: MUCOUS MEMBRANE IRRITATION & HARMFUL. INGESTION:
    HARMFUL.

==========  First Aid Measures  ==========

First Aid:EYE/SKIN: FLUSH W/WATER FOR 15-20 MINS. USE SOAP & WATER TO
    CLEANSE SKIN IF NO BURNS. INHALATION: REMOVE TO FRESH AIR.
    ADMINISTER OXYGEN IF BREATHING DIFFICULTY. ADMINISTER CPR IF
    CARDIAC ARREST OCCUR S. IF EXHIBITING SHOCK, KEEP WARM & QUIET.
    INGESTION: DRINK 1 TO 2 GLASSES OF WATER & INDUCE VOMITING. DON'T
    ADMINISTER LIQUIDS/INDUCE VOMITING TO AN UNCONSCIOUS/CONVULSING
    PERSON.   (SEE SUPP.)

==========  Fire Fighting Measures  ==========

Extinguishing Media:CO2, DRY CHEMICAL POWDER OR SPRAY.

==========  Accidental Release Measures  ==========

Spill Release Procedures:EVACUATE AREA. WEAR APPROPRIATE EQUIPMENT.
    VENTILATE AREA. SWEEP UP & PLACE IN AN APPROPRIATE CONTAINER. WASH
    CONTAMINATED SURFACES TO REMOVE ANY RESIDUES.

========== Handling and Storage  ==========

Handling and Storage Precautions:KEEP CLOSED IN A COOL DRY PLACE. STORE
    ONLY W/COMPATIBLE CHEMICALS. PRODUCT IS FURNISHED FOR LABORATORY
    USE ONLY. DON'T WEAR CONTACT LENSES.
Other Precautions:DON'T USE AS DRUGS, COSMETICS, AGRICULTURAL OR
    PESTICIDAL PRODUCTS, FOOD ADDITIVES OR AS HOUSEHOLD CHEMICALS.
    AVOID DIRECT PHYSICAL CONTACT. AVOID CONTACT W/SKIN, EYES &
    CLOTHING.

==========  Exposure Controls/Personal Protection  ==========

Respiratory Protection:USE APPROPRIATE OSHA/MSHA APPROVED SAFETY
    EQUIPMENT.
Ventilation:HANDLE ONLY IN A HOOD
Protective Gloves:AS REQUIRED
Eye Protection:EYE SHIELDS
Work Hygienic Practices:REMOVE/WASH CONTAMINATED CLOTHING BEFORE REUSE.
    ONLY TRAINED PERSONNEL SHOULD HANDLE THIS CHEMICAL OR ITS
    CONTAINER.
Supplemental Safety and Health
FIRST AID: IF PATIENT IS VOMITING, WATCH CLOSELY TO MAKE SURE AIRWAY
    DOESN'T BECOME OBSTRUCTED BY VOMIT. OBTAIN MEDICAL ATTENTION IN ALL
    CASES.

==========  Physical/Chemical Properties  ==========

Melt/Freeze Pt:M.P/F.P Text:237-240.8F
Vapor Pres:3
Vapor Density:1.57
```

Solubility in Water:SLIGHT
Appearance and Odor:COLORLESS, CRYSTALLINE SOLID

========== Stability and Reactivity Data ==========

Stability Indicator/Materials to Avoid:YES
LOW REACTIVITY

========== Disposal Considerations ==========

Waste Disposal Methods:BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AN AFTERBURNER & SCRUBBER. DISPOSE OF IN ACCORDANCE W/FEDERAL, STATE, & LOCAL REGULATIONS.

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MONSANTO COMPANY -- RODEO HERBICIDE -- 6840-01-356-8893

```
==========  Product Identification  ==========

Product ID:RODEO HERBICIDE
MSDS Date:11/01/1985
FSC:6840
NIIN:01-356-8893
MSDS Number: BBYFJ
=== Responsible Party ===
Company Name:MONSANTO COMPANY
Address:800 N. LINDBERGH BLVD.
City:ST. LOUIS
State:MO
ZIP:63167
Info Phone Num:(314) 694-4000
Emergency Phone Num:(314) 694-4000
CAGE:DO969
=== Contractor Identification ===
Company Name:MONSANTO COMPANY
Address:800 N LINDBERGH BLVD
Box:City:SAINT LOUIS
State:MO
ZIP:63167
Country:US
Phone:314-694-6661 OR 800-332-3111
CAGE:76541
Company Name:MONSANTO COMPANY
Address:800 N. LINDBERGH BLVD
City:ST. LOUIS
State:MO
ZIP:63167
Phone:314-694-1000
CAGE:DO969

==========  Composition/Information on Ingredients  ==========

Ingred Name:GLYCINE, (N-PHOSPHONOMETHYL) W/2-PROPANAMINE, ROUNDUP,
    GLYPHOSATE ISOPROPYLAMINE
CAS:38641-94-0
RTECS #:MC1080000
Fraction by Wt: 53.5%

Ingred Name:ISOPROPYLAMINE
CAS:75-31-0
RTECS #:NT8400000
Fraction by Wt: <3%
Other REC Limits:5 PPM
OSHA PEL:5 PPM/10 STEL
ACGIH TLV:5 PPM/10 STEL; 9192

Ingred Name:INERT INGREDIENTS (TYPE NOT SPECIFIED)
Fraction by Wt: 46.5%

==========  Hazards Identification  ==========

LD50 LC50 Mixture:ORAL RAT >5,000 MG/KG; NON-TOXIC
Routes of Entry: Inhalation:NO Skin:YES  Ingestion:NO
```

Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO
Health Hazards Acute and Chronic:SKIN: REPEATED DIDN'T PRODUCE SYSTEMIC EFFECTS AS DETERMINED BY HEMATOLOGY, CLINICAL CHEMISTRY & HISTOPATHOLOGIC EVALUATIONS. EYES: MAY CAUSE IRRITATION.
Explanation of Carcinogenicity:NONE
Effects of Overexposure:EYES: MAY CAUSE IRRITATION.

========== First Aid Measures ==========

First Aid:EYES: FLUSH W/PLENTY OF WATER FOR AT LEAST 15 MINS. CALL PHYSICIAN. SKIN: FLUSH W/WATER. WASH CLOTHING BEFORE REUSE.

========== Fire Fighting Measures ==========

Flash Point Method:TCC
Flash Point:>200F
Extinguishing Media:WATER SPRAY, FOAM, DRY CHEMICAL, CO2 OR ANY CLASS B EXTINGUISHING AGENT.
Fire Fighting Procedures:WEAR SELF CONTAINED BREATHING APPARATUS/FULL PROTECTIVE CLOTHING. EQUIPMENT SHOULD BE THOROUGHLY CLEANED AFTER USE.
Unusual Fire/Explosion Hazard:THIS GAS MIXTURE COULD FLASH OR EXPLODE, CAUSING SERIOUS PERSONAL INJURY.

========== Accidental Release Measures ==========

Spill Release Procedures:LIQUID SPILLS THAT SOAK INTO THE GROUND SHOULD BE DUG-UP, PLACED IN PLASTIC LINED METAL DRUMS/DISPOSED OF IN ACCORDANCE W/INSTRUCTIONS PROVIDED UNDER DISPOSAL. DON'T CONTAMINATE WATER, FOODSTUFFS, SEE D OR FEED BY STORAGE/DISPOSAL.
Neutralizing Agent:NONE

========== Handling and Storage ==========

Handling and Storage Precautions:STORE >10F TO KEEP FROM CRYSTALIZING. IF CRYSTALIZE, PLACE IN A WARM ROOM AT 68F FOR SEVERAL DAYS TO REDISOLVE/MIX WELL BEFORE USING.
Other Precautions:DON'T MIX STORE OR APPLY THIS PRODUCT OR SPRAY SOLUTIONS OF THIS PRODUCT IN GALVANIZED OR UNLINED STEEL (EXCEPT STAINLESS STEEL) CONTAINERS OR SPRAY TANKS. KEEP OUT OF REACH OF CHILDREN. AVOID CONTACT W/EYES, SKIN OR CLOTHING.

========== Exposure Controls/Personal Protection ==========

Respiratory Protection:DURING PERIODS OF ABNORMAL EXPOSURE TO HEAVY SPRAY OR MIST, USE OF NIOSH/MSHA APPROVED CARTRIDGE RESPIRATOR FOR PESTICIDES IS ADVISED.
Ventilation:NO SPECIAL PREACUATIONS RECOMMENDED.
Work Hygienic Practices:USE GOOD INDUSTRIAL HYGIENE PRACTICE. WASH CLOTHING BEFORE REUSE.
Supplemental Safety and Health
WEED KILLING COMPOUND, N.O.I.B.N.

========== Physical/Chemical Properties ==========

HCC:T5
Spec Gravity:1.22- 1.25

pH:4.8
Appearance and Odor:COLORLESS, ESSENTIALLY ODORLESS LIQUID

========== Stability and Reactivity Data ==========

Stability Indicator/Materials to Avoid:YES
STAINLESS STEEL, ALUMINUM, FIBERGLASS, PLASTIC, PLASTIC-LINE CONTAINER,
& CAUSTIC (BASIC)
Stability Condition to Avoid:OPEN FLAME, SPARK, WELDER'S TORCH,
IGNITION SOURCE, HEAT. STORE >10F TO KEEP FROM CRYSTALIZING.
Hazardous Decomposition Products:HYDROGEN GAS
Conditions to Avoid Polymerization:THIS ISN'T A POLYMERIZATION BUT
RATHER A CHEMICAL NEUTRALIZATION IN AN ACID-BASE REACTION.

========== Disposal Considerations ==========

Waste Disposal Methods:EMPTY CONTAINER RETAINS VAPOR/PRODUCT RESIDUE.
DON'T REUSE CONTAINER, DESTROY WHEN EMPTY. TRIPLE RINSE CONTAINER
THEN PUNCTURE/DISPOSE OF IN A SANITARY LANDFILL, OR INCINERATION,
IF ALLOWED BY STATE/L OCAL AUTHORITIES, BY BURNING, STAY OUT OF
SMOKE.

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document should seek competent professional advice to verify and
assume responsibility for the suitability of this information to their
particular situation.

DOW ELANCO -- 11388 TRANSLINE HERBICIDE -- 6840-00F032077

========== Product Identification ==========

Product ID:11388 TRANSLINE HERBICIDE
MSDS Date:06/08/1990
FSC:6840
NIIN:00F032077
MSDS Number: BSPSX
=== Responsible Party ===
Company Name:DOW ELANCO
Address:9002 PURDUE RD
City:INDIANAPOLIS
State:IN
ZIP:46268-1189
Country:US
Info Phone Num:800-352-6776/517-636-4400
Emergency Phone Num:517-636-4400/800-352-6776
CAGE:DOWEL
=== Contractor Identification ===
Company Name:DOW ELANCO
Address:QUAD IV, 9002 PURDUE RD
Box:City:INDIANAPOLIS
State:IN
ZIP:46268-1189
Country:US
Phone:517-636-4400
CAGE:0TNR0
Company Name:DOW ELANCO
City:INDIANAPOLIS
State:IN
ZIP:46268
Country:US
Phone:517-636-4400
CAGE:DOWEL

========== Composition/Information on Ingredients ==========

Ingred Name:CLOPYRALID (3,6-DICHLORO-2-PYRIDINECARBOXYLIC ACID) COMP
CAS:57754-85-5
Fraction by Wt: 40.9%

Ingred Name:WATER
CAS:7732-18-5
RTECS #:ZC0110000
Fraction by Wt: <59.1%

Ingred Name:ISOPROPANOL (ISOPROPYL ALCOHOL), 2-PROPANOL, DIMETHYL
CARBINOL
CAS:67-63-0
RTECS #:NT8050000
Fraction by Wt: <59.1%
Other REC Limits:400 PPM
OSHA PEL:400 PPM
ACGIH TLV:400 PPM

Ingred Name:SURFACTANT (TYPE NOT SPECIFIED)
Fraction by Wt: <59.1%

========== Hazards Identification ==========

LD50 LC50 Mixture:ORAL LD50 (MALE/FEMALE RATS): >5000MG/KG
Routes of Entry: Inhalation:YES Skin:NO Ingestion:YES
Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO
Health Hazards Acute and Chronic:EYES: SLIGHT TRANSIENT CORNEAL INJURY. SKIN: IRRITATION. INGESTION: INJURY. ISOPROPANOL MAY CAUSE EYE/NOSE/THROAT IRRITATION, CIRCULATORY COLLAPSE, RESPIRATION ARREST; MAY BE FATAL. REPEATED EXCESSIVE EXPOSURES MAY CAUSE LIVER & KIDNEY EFFECTS.
Explanation of Carcinogenicity:NONE
Effects of Overexposure:SKIN: DRYING, FLAKING. ISOPROPANOL: INCOORDINATION, CONFUSION, HYPOTENSION, HYPOTHERMIA. LETHARGY MAY BE A SIGN OR SYMPTOM OF EXCESSIVE EXPOSURE.

========== First Aid Measures ==========

First Aid:EYES: FLUSH W/WATER FOR 15 MINS. SKIN: WASH OFF IN FLOWING WATER OR SHOWER. INGESTION: INDUCE VOMITING IF LARGE AMOUNT INGESTED. INHALATION: REMOVE TO FRESH AIR. GIVE MOUTH-TO-MOUTH OR OXYGEN AS NECES SARY. NOTE TO PHYSICIAN: NO SPECIFIC ANTIDOTE. SUPPORTIVE CARE. TREATMENT BASED ON JUDGMENT OF PHYSICIAN IN RESPONSE TO REACTIONS OF THE PATIENT. OBTAIN MEDICAL ATTENTION IN ALL CASES.

========== Fire Fighting Measures ==========

Flash Point Method:TCC
Flash Point:117F,47.2C
Extinguishing Media:WATER FOG, ALCOHOL RESISTANT FOAM, CO2, DRY CHEMICAL; FOAM PREFERRED
Fire Fighting Procedures:WEAR A POSITIVE PRESSURE SELF-CONTAINED BREATHING APPARATUS & PROTECTIVE CLOTHING. MATERIAL IS WATER SOLUTION & EXCEPT UNDER GROSS FIRE CONDITIONS SHOULN'T BURN
Unusual Fire/Explosion Hazard:AVOID CONTAMINATING WATER SUPPLIES W/RUN-OFF WATER. COMBUSTIBLE.

========== Accidental Release Measures ==========

Spill Release Procedures:ABSORB W/INERT MATERIAL SUCH AS SAWDUST OR SAND. DIKE AREAS IN CASE OF LARGE SPILL. DON'T CONTAMINATE WATER SUPPLIES & IRRIGATION DITCHES.

========== Handling and Storage ==========

Handling and Storage Precautions:KEEP CONTAINER CLOSED. DON'T SHIP OR STORE W/FOOD, FEED, DRUGS OR CLOTHING. STORE UNDER COOL, DRY CONDITIONS. AVOID HIGH TEMPERATURES/DIRECT SUNLIGHT.
Other Precautions:KEEP OUT OF REACH OF CHILDREN/ANIMALS. DON'T SWALLOW. AVOID CONTACT W/EYES, SKIN & CLOTHING. COMBUSTIBLE, PREVENT SOURCES OF IGNITION, ESPECIALLY IF TEMPERATURES ARE NEAR/AT THE FLASHPOINT.

========== Exposure Controls/Personal Protection ==========

Respiratory Protection:USE AN APPROVED AIR-PURIFYING RESPIRATOR WHEN EXPOSURE LEVELS ARE EXCEEDED

Ventilation:GOOD GENERAL SHOULD BE SUFFICIENT FOR MOST CONDITIONS.
LOCAL EXHAUST MAY BE NECESSARY FROM SOME OPERATION.
Protective Gloves:IMPERVIOUS
Eye Protection:SAFETY GLASSES
Other Protective Equipment:CLEAN BODY-COVERING CLOTHING
Work Hygienic Practices:REMOVE/LAUNDER CONTAMINATED CLOTHING BEFORE REUSE. WASH THOROUGHLY AFTER HANDLING.
Supplemental Safety and Health

========== Physical/Chemical Properties ==========

Boiling Pt:B.P. Text:212F,100C
Vapor Pres:23.5
Vapor Density:1.06
Spec Gravity:1.161
Solubility in Water:COMPLETE
Appearance and Odor:DARK BROWN, CLEAR LIQUID W/SWEET ODOR

========== Stability and Reactivity Data ==========

Stability Indicator/Materials to Avoid:YES
ACIDS, OXIDIZING MATERIAL, HALOGENATED ORGANICS, BRASS, COPPER, ZINC, ALUMINUM
Stability Condition to Avoid:ELEVATED TEMPERATURES, DIRECT SUNLIGHT & OTHER IGNITION SOURCES
Hazardous Decomposition Products:HYDROGEN CHLORIDE, NITROGEN OXIDES, CHLORINATED PYRIDINE

========== Disposal Considerations ==========

Waste Disposal Methods:BURY WASTE MATERIAL IN APPROVED DUMP (NON-CROP LAND) AWAY FROM WATER SUPPLIES IN ACCORDANCE W/FEDERAL, STATE & LOCAL REGULATIONS.

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AQUA-KLEEN(R) GRANULAR AQUATIC HERBICIDE FOR CONTROLLING WATER WEEDS
MATERIAL SAFETY DATA SHEET Date Prepared: 08/24/00 Supersedes Date: 01/28/97

1. CHEMICAL PRODUCT AND COMPANY DESCRIPTION

AVENTIS CROP SCIENCE USA LP
2 T.W. Alexander Drive
Research Triangle Pk NC 27709

Emergency Phone Numbers:
Medical/Transport:
DART (800) 334-7577 24 Hours/Day
CHEMTREC(800) 424-9300 24 Hours/Day

For Product Information:
(888) AVENTIS 24 Hours/Day

Product Status:
FIFRA regulated use only.

EPA FIFRA Registration Number:
264-109

Chemical Name or Synonym:
2,4-D, BEE; 2,4-DICHLOROPHENOXYACETIC ACID, BUTOXYETHYL ESTER

Molecular Formula:
C14H18Cl2O4

2. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS Reg Number	OSHA Hazard	Percentage
ACETIC ACID, (2,4-DICHLOROPHENOXY)-, 2-BUTOXY ETHYL ESTER	1929-73-3	Y	27.6
CRYSTALLINE SILICA AS QUARTZ	14808-60-7	Y	6.7
OTHER INERT INGREDIENTS (TRADE SECRET)	**********	N	BALANCE

3. HAZARDS IDENTIFICATION

A. EMERGENCY OVERVIEW:
Physical Appearance and Odor:
tan granules solid, phenolic odor.

Warning Statements:
CAUTION!

B. POTENTIAL HEALTH EFFECTS:
Acute Eye:
May cause redness, tearing.

Acute Skin:
May be harmful if absorbed through the skin. May produce symptoms similar to those from ingestion.

Acute Inhalation:
Harmful if inhaled. May produce symptoms similar to those from ingestion.

Acute Ingestion:
May be harmful if swallowed. May cause nausea, vomiting, abdominal pain, decreased blood pressure, muscle weakness, muscle spasms.

Chronic Effects:
This product contains clay. Crystalline silica (e.g. quartz) is a naturally-occurring component of clay. Inhalation of crystalline silica may cause pulmonary fibrosis (silicosis). The International Agency for Research on Cancer (IARC) has classified crystalline silica as a probable human carcinogen (Group 2A). (See Section 11 - Chronic.) Prolonged contact can cause liver damage, kidney damage, chronic muscle damage.

4. FIRST AID MEASURES

FIRST AID MEASURES FOR ACCIDENTAL:
Eye Exposure:
Hold eyelids open and flush with a steady, gentle stream of water for at least 15 minutes. Seek immediate medical attention.

Skin Exposure:
In case of contact, immediately wash with plenty of soap and water for at least 5 minutes. Seek medical attention if irritation develops or persists. Remove contaminated clothing and shoes. Clean contaminated clothing and shoes before re-use.

Inhalation:
Remove victim from immediate source of exposure and assure that the victim is breathing. If breathingis difficult, administer oxygen, if available. If victim is not breathing, administer CPR (cardio-pulmonary resuscitation). Seek immediate medical attention.

Ingestion:
If victim is conscious and alert, give 2-3 glasses of water to drink and induce vomiting by touching back of throat with a finger. Do not induce vomiting or give anything by mouth to an unconscious person. Seek immediate medical attention. Do not leave victim unattended. Vomiting may occur spontaneously. To prevent aspiration of swallowed product, lay victim on side with head lower than waist. If vomiting occurs and the victim is conscious, give water to further dilute the chemical.

MEDICAL CONDITIONS POSSIBLY AGGRAVATED BY EXPOSURE:
Inhalation of product may aggravate existing chronic respiratory problems such as asthma, emphysema or bronchitis. Skin contact may aggravate existing skin disease.

NOTES TO PHYSICIAN:
All treatments should be based on observed signs and symptoms of distress in the patient. Consideration should be given to the possibility that overexposure to materials other than this product may have occurred.

Treatsymptomatically. No specific antidote available.

This product contains a phenoxy herbicide. Myotoxic effects may include muscle fibrillations, myotonia, and muscular weakness. Ingestion of massive doses may result in persistent fall of blood pressure. Myoglobin and hemoglobin may be found in urine. Elevations in lactate dehydrogenase (LDH), SGOT, SGPT and aldolase indicate the extent of muscle damage. It has been suggested that overexposure in humans may affect both the central and peripheral nervous systems. The acute effects on the central nervous system resemble those produced by alcohol or sedative drugs. In isolated cases, peripheral neuropathy and reduced nerve conduction velocities have been reported although these observations may be related to other factors.

Gas-liquid chromatography for detecting and measuring chlorophenoxy compounds in blood and urine may be useful in confirming and assessing the magnitude of chlorophenoxy absorption.

5. FIRE FIGHTING MEASURES

FIRE HAZARD DATA:
Flash Point:
Not Applicable

Extinguishing Media:
Recommended (large fire): foam, water spray,Recommended (small fires): dry chemical, carbon dioxide.

Special Fire Fighting Procedures:
Firefighters shouldwear NIOSH/MSHA approved self-contained breathing apparatus and full protectiveclothing. Dike area to prevent runoff and contamination of water sources. Dispose of fire control water later.

Unusual Fire and Explosion Hazards:
Under fire conditions, toxic, corrosive fumesare emitted.

Hazardous Decomposition Materials (Under Fire Conditions):
hydrogen chloride
oxides of sulfur
oxides of carbon

6. ACCIDENTAL RELEASE MEASURES

Evacuation Procedures and Safety:
Wear appropriate protective gear for the situation. See Personal Protection information in Section 8.

Containment of Spill:
Follow procedure described below under Cleanup and Disposal of Spill.

Cleanup and Disposal of Spill:
Avoid creation of dusty conditions. Scrape up and place inappropriate closed container (see Section 7: Handling and Storage). Decontaminate tools and equipment following cleanup.

Environmental and Regulatory Reporting:
Prevent material from entering public sewer system or any waterways. Do not flush to drain. If spilled on the ground, the affected area should be scraped clean and placed in a appropriate container for disposal. Spills may be reportable to the National Response Center (800-424-8802) and to state and/or local agencies.

7. HANDLING AND STORAGE

Minimum/Maximum Storage Temperatures:
Not Available

Handling:
Do not get on skin or in eyes. Do not ingest. Do not breathe dusts. Use handling, storage and disposal procedures that will prevent contamination of water, food or feed.

Storage:
Store in an area that is away from food, feedstuffs, fertilizers and seed.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Introductory Remarks:
These recommendations provide general guidance for handling this product. Because specific work environments and material handling practices vary, safety procedures should be developed for each intended application. While developing safe handling procedures, do not overlook the need to clean equipment and piping systems for maintenance and repairs. Waste resulting from these procedures should be handled in accordance with Section 13: Disposal Considerations.

Assistance with selection, use and maintenance of worker protection equipment is generally available from equipment manufacturers.

Exposure Guidelines:
Exposure limits represent regulated or recommended worker breathing zone concentrations measured by validated sampling and analytical methods, meeting the regulatory requirements. The following limits apply to this material, where, if indicated, S=skin and C=ceiling limit:

ACETICACID, (2,4-DICHLOROPHENOXY)-, 2-BUTOXYETHYL ESTER

	Notes	TWA	STEL

CRYSTALLINE SILICAAS QUARTZ

	Notes	TWA	STEL
ACGIH		0.1 mg/cu m	
OSHA		0.1 mg/cu m	

Engineering Controls:
Where engineering controls are indicated by use conditions or a potential for excessive exposure exists, the following traditional exposure control techniques may be used to effectively minimize employee exposures: local exhaust ventilationat the point of generation.

Respiratory Protection:
When respirators are required, select NIOSH/MSHAapproved equipment based on actual or potential airborne concentrations and in accordance with the appropriate regulatory standards and/or industrial recommendations.

Under normal conditions, in the absence of other airborne contaminants, the following devices should provide protection from this material up to the conditions specified by the appropriate OSHA, WHMIS or ANSI standard(s): Air-purifying (half-mask/full-face) respirator with cartridges/canister approved for use against pesticides.
Under conditions immediately dangerous to life or health, oremergency conditions with unknown concentrations, use a full-face positive pressure air-supplied respirator equipped with an emergency escape air supply unit or use a self-contained breathing apparatus unit.

Eye/Face Protection:
Eye and face protection requirements will vary dependent upon work environment conditions and material handling practices. Appropriate ANSI Z87 approved equipment should be selected for the particular use intended for this material.

Eye contact should be prevented through use of chemical safety glasses with side shields or splash proof goggles. An emergency eye wash must be readily accessible to the work area.

Skin Protection:
Skin contact must be prevented through the use of permeation resistant clothing, gloves and footwear, selected with regard for use conditions and exposure potential. An emergency shower must be readily accessible to the work area. Consideration must be given both to durability as well as permeation resistance.

Work Practice Controls:
Personal hygiene is an important work practice exposure control measure and the following general measures should be taken when working with or handling this material:

(1) Donot store, use, and/or consume foods, beverages, tobacco products, or cosmetics in areas where this material is stored.
(2) Wash hands and face carefully before eating, drinking, using tobacco, applying cosmetics, or using the toilet.
(3) Wash exposed skin promptly to remove accidental splashes of contact with this material.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical and Chemical properties here represent typical properties of this product. Contact the business area using the Product Information phone number in Section 1 for its exact specifications.

Physical Appearance:
tan granules solid.

Odor:
phenolic odor.

pH:
Not Applicable

Specific Gravity:
Not Available

Water Solubility:
insoluble

Melting Point Range:
Not Available

Boiling Point Range:
Not Available

Vapor Pressure:
Not Available

Vapor Density:
Not Available

Molecular Weight:
321.22

10. STABILITY AND REACTIVITY

Chemical Stability:
This material is stable under normal handling and storage conditions described in Section 7.

Conditions To Be Avoided:
none known

Materials/Chemicals To Be Avoided:
strong oxidizing agents
bases
acids

The Following Hazardous Decomposition Products Might Be Expected:
Decomposition Type: thermal
hydrogen chloride
oxides of sulfur

Hazardous Polymerization Will Not Occur.
Avoid The Following To Inhibit Hazardous Polymerization:
not applicable

11. TOXICOLOGICAL INFORMATION

Acute Eye Irritation:
Toxicological Information and Interpretation
eye - eye irritation, rabbit.
Slightly irritating.

Acute Skin Irritation:
Toxicological Information and Interpretation
skin - skin irritation, rabbit.
Non-irritating to minimally irritating.

Acute Dermal Toxicity:
Toxicological Information and Interpretation
LD50 - lethal dose 50% of test species, > 2000 mg/kg, rabbit.

Acute Respiratory Irritation:
No test data found for product.

Acute Inhalation Toxicity:
No test data found for product.

Acute Oral Toxicity:
Toxicological Information and Interpretation
LD50 - lethal dose 50% of test species, 4050 mg/kg, rat.

Chronic Toxicity:
This product contains the substances that are considered to be probable or suspected human carcinogens as follows:

	Regulatory Agency Listing Carcinogen			
Ingredient Name	**OSHA**	**IARC**	**NTP**	**ACGIH**
CRYSTALLINE SILICA AS QUARTZ	No	No	Yes	No
CHLOROPHENOXY HERBICIDES	No	2B	No	No
SILICA, CRYSTALLINE	No	2A	No	No

Chlorophenoxy herbicides are listed as class 2B carcinogens (limited evidence for carcinogenicity in humans) by the International Agency for Research on Cancer (IARC). The Science Advisory Panel of USEPA has given a Class D classification (not classificable as to human carcinogenicity) and has required additional animal studies on 2,4-D. Various animal cancer tests have shown no reliable positive association between 2,4-D exposure and cancer. Recent results from a lifetime study in laboratory animals did not show evidence of carcinogeniceffects caused by 2,4-D. Animal studies with the active ingredients in this product have shown that they are not mutagenic or teratogenic.

12. ECOLOGICAL INFORMATION

Ecotoxicological Information
For ecotoxicological data call the product information phone number listed in Section 1.

Chemical Fate Information:
For chemical fate data call the product information phone number listed in Section 1.

13. DISPOSAL CONSIDERATIONS

Waste Disposal Method:
Chemical additions, processing or otherwise altering this material may make the waste management informationpresented in this MSDS incomplete, inaccurate or otherwise inappropriate. Please be advised that state and local requirements for waste disposal may be more restrictive or otherwise different from federal laws and regulations. Consult state and local regulations regarding the proper disposal of this material.

Container Handling and Disposal:
Any containers or equipment used should be decontaminated immediately after use.
Consult state and local regulations regarding the proper disposal of container.

EPA Hazardous Waste - YES

14. TRANSPORTATION INFORMATION

Transportation Status:
The listed Transportation Classification does not address regulatory variations due to changes in package size, mode of shipment or other regulatory descriptors.

US Department of Transportation
Shipping Name:
NOT REGULATED

15. REGULATION INFORMATION

FEDERAL REGULATIONS
TSCA Inventory Status:
This product is excluded from TSCA because it is solely for FIFRA regulated use.

SARA Title III Hazard Classes:

Fire Hazard	- NO
Reactive Hazard	- NO
Release of Pressure	- NO
Acute Health Hazard	- YES
Chronic Health Hazard	- YES

SARA 313 Chemicals
ACETIC ACID, (2,4-DICHLOROPHENOXY)-, 2-BUTOXYETHYL ESTER (27.6%)

SARA Extremely Hazardous Substances (EHS)/CERCLA Hazardous Substances

Ingredient	CERCLA/SARA RQ	SARA EHS TPQ
ACETIC ACID, (2,4-DICHLOROPHENOXY)-, 2-BUTOXYETHYL ESTER	100 lbs	
UNLISTED HAZ. WASTE CHARACTERISTIC OF EP TOXICITY - 2,4-D	100 lbs	

STATE REGULATIONS:
This product contains the following components that are regulated under California Proposition 65:

Ingredient Name	Cancer List	Reprod. List	No Sign. California	Risk Lvl (ug/day) Mfg
SILICA, CRYSTALLINE (AIRBORNE PARTICLES OF RESPIRABLE SIZE)	Y	N	ND	ND

16. OTHER INFORMATION

National Fire Protection Association Hazard Ratings--NFPA(R):
2 Health Hazard Rating--Moderate
1Flammability Rating--Slight
0 Instability Rating--Minimal

National Paint & Coating Hazardous Materials Identification
1 Health Hazard Rating--Slight
1 Flammability Rating--Slight

MSDS by MSDS Number

/TD>

Our database contains over 10,000 MSDS representing over 80,000 unique product codes. Your search will be more successful if you fill in as much information as possible.

Univar USA
6100 Carillon Point
Kirkland WA 98033
425-889-3400

For Emergency Assistance involving chemicals call - CHEMTREC (800) 424-9300

MSDS Number:P21436VS MSDS Version:001

001 07/15/98 GARLON 3A HERBICIDE

```
********************************************************************************
                          PRODUCT IDENTIFICATION
********************************************************************************

PRODUCT NAME:   GARLON 3A HERBICIDE

MSDS#:          P21436VS

DATE ISSUED:    1/1/98

SUPERSEDES:     NEW

ISSUED BY:      008366

GARLON* 3A HERBICIDE

1. PRODUCT IDENTIFICATION: .
PRODUCT: GARLON* 3A HERBICIDE

2. COMPOSITION/INFORMATION ON INGREDIENTS
Triclopyr ((3,5,6-trichloro-2- pyridinyl)oxy)acetic acid),
as the triethylamine salt CAS# 057213-69-1 44.4%
Other ingredients, total, including:
55.6%
Proprietary surfactants
Ethanol (1%)
Triethylamine
(N,N-Diethylethanamine) CAS# 000121-44-8
CAS# 000064-17-5
This document is prepared pursuant to the OSHA Hazard
Communication Standard (29 CFR) 1910.1200). In addition,
other substances not 'Hazardous' per this OSHA Standard
may be listed. Where proprietary ingredient shows, the
identity may be made available as provided in this
standard.

3. HAZARDOUS IDENTIFICATIONS:
EMERGENCY OVERVIEW
Hazardous Chemical. Light purple-pink liquid, ammonia-like
odor. May cause severe eye irritation with corneal injury
which may result in permanent impairment of vision, even
blindness. Prolonged or repeated exposure may cause skin
irritation, even a burn. LD50 for skin absorption in rabbits is
>5000 mg/kg; oral LD50 for male rats is 2600 mg/kg and
1900 mg/kg for female rats. Toxic and irritating gases may
be formed during fire conditions.

EMERGENCY PHONE NUMBER: (U.S.) 800-992-5994

POTENTIAL HEALTH EFFECTS: This section includes
possible adverse effects which could occur if this material
is not handled in the recommended manner.
EYE: May cause severe irritation with corneal injury which
may result in permanent impairment of vision, even
```

2

blindness. Vapors of amines may cause swelling of the cornea resulting in visual disturbances such as blurred smoky or halo vision. When tested on animals, dilutions of this material were less irritating to eyes than the undiluted product.

SKIN: Prolonged or repeated exposure may cause skin irritation, even a burn. When tested on animals, dilutions of this material were less irritating to skin than the undiluted product. Prolonged or frequently repeated skin contact may cause allergic skin reactions in some individuals. With the dilute mix, no allergic skin reaction is expected. A single prolonged exposure is not likely to result in the material being absorbed through the skin in harmful amounts. The LD50 for skin absorption in rabbits is >5000 mg/kg.

INGESTION: Single dose oral toxicity is low. The oral LD50 was 2600 mg/kg for male rats and 1900 mg/kg for female rats. Small amounts swallowed incidental to normal handling operations are not likely to cause injury; swallowing amounts larger than that may cause injury. Ingestion may cause gastrointestinal irritation or ulceration.

INHALATION: A single brief (minutes) inhalation exposure is not likely to cause adverse effects. This material contains ethanol (minor component).

SYSTEMIC (OTHER TARGET ORGAN) EFFECTS:
Excessive exposure may cause liver or kidney effects. Ethanol, a minor component, has caused central nervous system and liver effects.

CANCER INFORMATION: Triclopyr did not cause cancer in long-term animal studies. This material contains ethanol. Epidemiology studies provide evidence that drinking of alcoholic beverages (containing ethanol) is associated with cancer, and IARC has classified alcoholic beverages as carcinogenic to humans.

TERATOLOGY (BIRTH DEFECTS): For triclopyr, birth defects are unlikely; even exposures having an adverse effect on the mother should have no effect on the fetus. Ethanol has been shown to cause birth defects and toxicity to the fetus in laboratory animal tests. It has also been shown to cause human fetotoxicity and/or birth defects when ingested during pregnancy.

REPRODUCTIVE EFFECTS: In animal studies, triclopyr has been shown not to interfere with reproduction. Ethanol, a minor component, has produced some adverse effects on male fertility in laboratory animals and humans.

4. FIRST AID:
EYES: Irrigate with flowing water immediately and continuously for 15 minutes. Consult medical personnel.
SKIN: Wash off in flowing water or shower.
INGESTION: Do not induce vomiting. Give large amounts of water or milk if available and transport to medical facility.
INHALATION: No adverse effects anticipated by this route of exposure.

NOTE TO PHYSICIAN: Ingestion may cause tissue destruction leading to stricture. If lavage is performed, endotracheal and/or esophageal control is suggested. If burn is present, treat as any thermal burn, after decontamination. No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient.

5 FIRE FIGHTING MEASURES:
.
FLASH POINT: 110 F, 43 C METHOD USED: TCC
FLAMMABLE LIMITS
LFL: Not determined UFL: Not determined

EXTINGUISHING MEDIA: Alcohol foam and C02.

FIRE & EXPLOSION HAZARDS: Toxic, irritating vapors may be formed or given off if product is involved in fire. Although product is water- based, it has a flash point due to

3

the presence of small amounts of ethanol and
triethylamine.

FIRE-FIGHTING EQUIPMENT: Use positive-pressure, self-
contained breathing apparatus and full protective clothing.

6. ACCIDENTAL RELEASE MEASURES:
(See Section 15 for Regulatory Information)

ACTION TO TAKE FOR SPILLS/LEAKS: Dike large spills.
Keep out of streams and domestic water supplies. Absorb
small spills in inert material such as dry sand.

7 HANDLING AND STORAGE:

PRECAUTIONS TO BE TAKEN IN HANDLING AND
STORAGE:
HANDLING: Keep out of reach of children. Causes
irreversible eye damage. Harmful if inhaled or absorbed
through skin. Prolonged or frequently repeated skin contact
may cause allergic skin reaction in some individuals. Avoid
contact with eyes, skin, clothing, breathing vapor, or spray
mist. Users should wash hands before eating, drinking,
chewing gum, using tobacco, or using the toilet.

STORAGE: Store above 28 F or agitate before use. Store
in original container. See product label for handling/storage
precautions relative to the end use of this product.

8- EXPOSURE CONTROLS / PERSONAL PROTECTION:
These precautions are suggested for conditions with a high
potential for exposure. If handling procedures are such that
there is only a low potential for exposure, less protection
may be needed. Emergency conditions may require
additional precautions.

EXPOSURE GUIDELINE(S):
Ethanol (ethyl alcohol): ACGIH TLV and OSHA PEL are
1000 ppm. 3,5,6-Trichloro-2-pyridyloxyacetic acid
(Triclopyr), triethylamine salt: vendor Industrial
Hygiene Guideline is 2 mg/m3 as acid equivalent; Skin.
Triethylamine: ACGIH TLV is 1 ppm TWA, 3 ppm STEL,
Skin. OSHA PEL is 10 ppm TWA, 15 ppm STEL. PELs are
in accord with those recommended by OSHA, as in the
1989 revision of PELs.

ENGINEERING CONTROLS: Provide general and/or local
exhaust ventilation to control airborne levels below the
exposure guidelines.

RESPIRATORY PROTECTION: Atmospheric levels should
be maintained below the exposure guideline. When
respiratory protection is required for certain operations, use
a NIOSH approved air-purifying respirator.

SKIN PROTECTION: When prolonged or frequently
repeated contact could occur, use protective clothing
impervious to this material. Selection of specific items such
as faceshield, gloves, boots, apron or full-body
suit will depend on operation.

EYE PROTECTION: Use chemical goggles. Eye wash
fountain should be located in immediate work area. If vapor
exposure causes eye discomfort, use a NIOSH approved
full-face respirator.

9. PHYSICAL AND CHEMICAL PROPERTIES:
BOILING POINT: Not determined
VAPOR PRESSURE: Not determined
VAPOR DENSITY: Not applicable
SOLUBILITY IN WATER: High
SPECIFIC GRAVITY: 1.135 (68/68 F)
APPEARANCE: Light purple/pink liquid
ODOR: Ammonia-like odor

Contact your state pesticide or environmental control
agency, or the hazardous waste representative at the
nearest EPA regional office for guidance.

10. STABILITY AND REACTIVITY:

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STABILITY: (CONDITIONS TO AVOID) Avoid sources of ignition if temperature is near or above flash point.

INCOMPATIBILITY: (SPECIFIC MATERIALS TO AVOID) Any oxidizing agent. Consult manufacturer for specific cases.

HAZARDOUS DECOMPOSITION PRODUCTS: Nitrogen oxides and hydrogen chloride may be formed under fire conditions.

HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL INFORMATION:
(See Section 3 for Potential Health Effects. For detailed toxicological data, write the address shown in Section 1 or call the emergency number)

MUTAGENICITY: For triclopyr and ethanol: in-vitro mutagenicity studies were negative. For triclopyr: animal mutagenicity studies were negative. For ethanol: animal mutagenicity studies were negative in some cases and positive in other cases. Ethanol is not believed to be a direct acting mutagen.

12 ECOLOGICAL INFORMATION

(For detailed Ecological data, write the address shown in Section 1 or call the emergency number)

ENVIRONMENTAL FATE: DEGRADATION & PERSISTENCE: Biodegradation under aerobic static laboratory conditions is high (BOD20 or BOD28/ThOD >40 /O). 20-Day biochemical oxygen demand (BOD20) is 0.03 p/p. Theoretical oxygen demand (ThOD) is calculated to be 0.75 p/p.

ECOTOXICOLOGY: Material is practically non-toxic to aquatic organisms on an acute basis (LC50 >100 mg/L in most sensitive species). Growth inhibition EC50 for green alga (Selenastrum capricornutum) is 45 mg/L.

13. DISPOSAL CONSIDERATIONS:
DISPOSAL METHOD: Do not contaminate food, feed, or water by storage or disposal. Pesticide wastes are toxic. Improper disposal or excess pesticide, spray mixture, or rinsate is a violation of federal law. If wastes resulting from the use of this product cannot be disposed of according to label instructions, dispose of these wastes at an approved facility.

14. TRANSPORT INFORMATION:
For DOT regulatory information, if required, consult transportation regulations, product shipping papers, or contact your vendor representative.

15. REGULATORY INFORMATION:
NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given.

Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations.

U.S. REGULATIONS
SARA 313 INFORMATION: This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372:

CHEMICAL NAME CAS # CONCENTRATION
N,N-DIETHYLETHANAMINE 000121-448 4 %

SARA HAZARD CATEGORY: This product has been reviewed according to the EPA "Hazard Categories"

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promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

An immediate health hazard
A delayed health hazard
A fire hazard

TOXIC SUBSTANCES CONTROL ACT (TSCA):
All ingredients are on the TSCA inventory or are not required to be listed on the TSCA inventory.

STATE RIGHT-TO-KNOW: The following product components are cited on certain state lists as mentioned. Non-listed components may be shown in the composition section of the MSDS.

CHEMICAL NAME CAS NUMBER LIST
PROPRIETARY INGREDIENT NJ3 PA3 PA1
ETHANOL 000064-17-5 NJ1 NJ3 PA1
N,N-DIETHYLETHANAMINE 000121-44-8 NJ1 NJ3 PA3 PA1
NJ1=New Jersey Special Health Hazard Substance (present at greater than or equal to 0.1 %).
NJ3=New Jersey Workplace Hazardous Substance (present at greater than or equal to 1.0%).
PA1=Pennsylvania Hazardous Substance (present at greater than or equal to 1.0%).
PA3=Pennsylvania Environmental Hazardous Substance (present at greater than or equal to 1.0%).

OSHA HAZARD COMMUNICATION STANDARD:
This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) RATINGS:
Health 3
Flammability 2
Reactivity 0
COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY ACT (CERCLA, or SUPERFUND):
This product contains the following substance(s) listed as "Hazardous Substances" under CERCLA which may require reporting of releases: Category

Chemical Name CAS# RQ % in Product

Triethylamine 000121 -44-8 5000 3%
Proprietary Ingredient 000060-00-4 5000 2.3%

RCRA Categorization
Hazardous Code:
Triethylamine = U4040

Emergency Phone: 800-992-5994

16 OTHER INFORMATION:

For Additional Information:
Contact: MSDS Coordinator – Univar USA
During business hours, Pacific Time – (425) 889–3400

NOTICE
Univar USA, expressly disclaims all express or implied warranties of merchantibility and fitness for a particular purpose, with respect to the product or information provided herein, and shall under no circumstances be liable for incidental or consequential damages.

Do not use ingredient information and/or ingredient percentages in this MSDS as a product specification. For product specification information refer to a Product Specification Sheet and/or a Certificate of Analysis. These can be obtained from your local Univar USA Sales Office.

All information appearing herein is based upon data obtained from the manufacturer and/or recognized technical sources. While the information is believed to be accurate, Univar USA makes no representations as to its accuracy or sufficiency. Conditions of use are beyond Univar USA's control and therefore users are responsible to verify this data under their own operating conditions to determine whether the product is suitable for their particular purposes and they assume all risks of their use, handling, and disposal of the product, or from the publication or use of, or reliance upon, information contained herein. This information relates only to the product designated herein, and does not relate to its use in combination with any other material or in any other process.

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END OF MSDS


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Material Safety Data Sheet

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Original Date: 10/31/2000
Revision Date: 12/20/2002

BASF CORPORATION
AGRICULTURAL PRODUCTS
P.O. BOX 13528
RESEARCH TRIANGLE PK, NC 27709
(919) 547-2000

EMERGENCY TELEPHONE: (800) 832-HELP BASF
(800) 832-HELP (BASF Hotline)
BOTH NUMBERS ARE AVAILABLE DAYS, NIGHTS, WEEKENDS, & HOLIDAYS.

SECTION 1 - PRODUCT INFORMATION

PLATEAU® DG HERBICIDE
Product ID: NVA 579652
Common Chemical Name:
See Section 2
Synonyms:
Imazapic; AC 263,222; Plateau DG herbicide ECO-PAK
Molecular Formula:
C(14) H(17) N(3) O(3)
Chemical Family: Imidazolinone
Molecular Wt.: 275.3

SECTION 2 - INGREDIENTS

Chemical Name:	CAS	Amount
AC 263, 222 (IMAZAPIC)	104098-48-8	70.0 %
PEL/TLV NOT ESTABLISHED		
INERTS	INERTS	30.0 %
PEL/TLV NOT ESTABLISHED		

Chemical Name: 2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-5-methyl-3-pyridinecarboxylic acid
2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-5-methyl-3-pyridinecarboxylic acid

SECTION 3 - PHYSICAL PROPERTIES

Color: Beige
Form/Appearance: Granules
Odor: Odorless
Odor Intensity: None

	Typical	Low/High	U.O.M.
Specific Gravity:	NOT AVAILABLE		
Bulk Density:	37.46		LB/CU. FT
pH:	3.1		SU

	Typical	Low/High	Deg.	@	Pressure
Boiling Pt:	NOT AVAILABLE				

PLATEAU® DG HERBICIDE
NVA 579652

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SECTION 3 - PHYSICAL PROPERTIES (cont)

	Typical	Low/High	Deg.	@	Pressure
Freezing Pt:	NOT AVAILABLE				
Decomp. Tmp:	NOT AVAILABLE				

Solubility in Water Description: Dispersible

SECTION 4 - FIRE AND EXPLOSION DATA

	Typical	Low/High	Deg.	Method
Flash Point:	NOT AVAILABLE			
Autoignition:	NOT AVAILABLE			

Extinguishing Media:
Use water fog, foam or dry chemical extinguishing media.
Fire Fighting Procedures:
Firefighters should be equipped with self-contained breathing apparatus and turn out gear.
Unusual Hazards:
May form explosive dust-air mixtures.

SECTION 5 - HEALTH EFFECTS

Routes of entry for solids and liquids include eye and skin contact, ingestion and inhalation. Routes of entry for gases include inhalation and eye contact. Skin contact may be a route of entry for liquified gases.

Toxicology Test Data:
Rat, Oral LD50 - >5000 MG/KG
Slightly Toxic/Practically Nontoxic
Rat, Dermal LD50 - >2000 MG/KG
Slightly Toxic
Rat, 4 hr Inhalation LC50 - >2.3 MG/L
Moderately Toxic
Rat, 1 hr Inhalation LC50 - >9.2 MG/L
Moderately Toxic
Rabbit, Eye Irritation -
Slightly irritating
Rabbit, Primary Skin Irritation -
Slightly irritating
Guinea Pig, Skin Sensitization -
Not a sensitizer
Data for the formulated product.

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Acute Overexposure Effects:
  CAUTION! KEEP OUT OF REACH OF CHILDREN.
  Harmful if absorbed through the skin.
  Causes moderate eye irritation.
Chronic Overexposure Effects:
  Overexposure to crystalline silica results in silicosis, a lung
  disease characterized by coughing, difficult breathing, wheezing,
  scarring of the lungs, and repeated, non-specific chest illnesses.
  The International Agency for Research on Cancer (IARC) has
PLATEAU® DG HERBICIDE
NVA 579652 Page : 3

SECTION 5 - HEALTH EFFECTS (cont)

  classified crystalline silica in Group 1 (those agents with evidence
  of carcinogenicity to humans) and National Toxicology Program (NTP)
  has included it in its Annual Report on Carcinogens.
Other Overexposure Effects:
  See Product Label and Directions for Use for additional precautionary
  statements.
First Aid Procedures - Skin:
  Take off contaminated clothing. Rinse skin immediately with plenty
  of water for 15-20 minutes. Call a poison control center or doctor
  for treatment advice.
First Aid Procedures - Eyes:
  Hold eyes open and rinse slowly and gently with water for 15-20
  minutes. Remove contact lenses, if present, after first 5 minutes,
  then continue rinsing. Call a poison control center or doctor for
  treatment advice.
First Aid Procedures - Ingestion:
  Call a poison control center or doctor immediately for treatment
  advice. Have person sip a glass of water if able to swallow. Do
  not induce vomiting unless told to by a poison control center or
  doctor. Do not give anything to an unconscious person.
First Aid Procedures - Inhalation:
  Move person to fresh air. If person is not breathing, call 911 or an
  ambulance, then give artificial respiration, preferably mouth-to-
  mouth if possible. Call a poison control center or doctor for
  further treatment advice.
First Aid Procedures - Notes to Physicians:
  Treatment is symptomatic.
First Aid Procedures - Aggravated Medical Conditions:
  No information found for this mixture.
First Aid Procedures - Special Precautions:
  None
Other First Aid Procedures:
  Have the product container or label with you when calling a poison
  control center or doctor or going for treatment.

SECTION 6 - REACTIVITY DATA

Stability Data:
  Stable.
Incompatability:
  Strong oxidizers.
Conditions/Hazards to Avoid:
  Store in original container in cool, dry, well ventilated place away
  from ignition sources, heat or flame.
Hazardous Decomposition/Polymerization:
  Including but not limited to oxides of carbon and nitrogen.
Corrosive Properties:
  Not corrosive.
Oxidizer Properties:
  Not an oxidizer
Other Reactivity Data:
  None known.
PLATEAU® DG HERBICIDE
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SECTION 7 - PERSONAL PROTECTION

Clothing:
  Gloves, long sleeved shirt and slacks.
Eyes:
  Chemical goggles when respirator does not provide eye protection.
Respiration:
  Supplied air respirators should be worn if large quantities of dust
  are generated or prolonged exposure possible.
Ventilation:
  Whenever possible, engineering controls should be used to minimize
  the need for personal protective equipment.
Explosion Proofing:
  None required.
Other Personal Protection Data:
  None under normal conditions.

SECTION 8 - SPILL-LEAK/ENVIRONMENTAL

General:
  In case of large scale spillage of this product, avoid contact,
  isolate area and keep out animals and unprotected persons. Call
  CHEMTREC (800-424-9300) or BASF Corporation (800-832-HELP). For a
  small spill, wear personal protective equipment as specified on the
  label.
  FOR A LIQUID SPILL: Dike and contain the spill with inert material
  (sand, earth, etc) and transfer the liquid & solid diking materials
  to separate containers for disposal.
  FOR A SOLID SPILL: Sweep solid into drum for re-use or disposal.
  Remove personal protective equip. & decontaminate it prior to reuse.
Waste Disposal:

Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mix or rinsate is a violation of federal law. If these wastes cannot be disposed of according to label instructions, contact your State Pesticide or Environmental Control Agency or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

Container Disposal:
FOR PLASTIC CONTAINERS: Triple rinse (or equivalent) & add rinsate to spray tank. Offer for recycling or reconditioning, or puncture & dispose of in sanitary landfill, or by incinceration, or if allowed by state & local authorities, by burning. If burned, stay out of smoke.
FOR BULK CONTAINERS: Reusable containers should be returned to the point of purchase for cleaning and re-filling.
FOR MINIBULK CONTAINERS: Clean all tanks on an approved loading pad so rinsate can be collected & mixed into the spray solution or into a dedicated tank. Using a high pressure sprayer, rinse several times with small volumes of water to minimize rinsate.
See the product label for information regarding environmental toxicity

PLATEAU® DG HERBICIDE
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SECTION 9 - STORAGE AND HANDLING

General:
Store in original container separate from other pesticides, fertilizers, food and feed.

SECTION 10 - REGULATORY INFORMATION

TSCA Inventory Status
Listed on Inventory: NO
Not Listed, TSCA Exempt: YES FDA Only: NO FIFRA Only: YES

RCRA Haz. Waste No .:
CERCLA: NO Reportable Qty.: (If YES)
EPA Registration No.: 241-393
EPA Reg. No. 241-393
Keep out of reach of children
CAUTION

SECTION 11 - TRANSPORTATION INFORMATION

DOT Proper Shipping Name:
SEE BELOW
DOT Technical Name:
SEE BELOW
DOT Primary Hazard Class:
SEE BELOW
DOT Secondary Hazard Class:

DOT Label Required:
SEE BELOW
DOT Placard Required:
SEE BELOW
DOT Poison Constituent:

BASF Commodity Codes: UN/NA Code: E/R Guide:
Bill of Lading Description:
COMPOUNDS,TREE OR WEED KILLING (HERBICIDES),NOIBN
THIS PRODUCT IS NOT REGULATED BY DEPARTMENT OF TRANSPORTATION.
"IMPORTANT: WHILE THE DESCRIPTIONS, DESIGNS, DATA AND INFORMATION CONTAINED HEREIN ARE PRESENTED IN GOOD FAITH AND BELIEVED TO BE ACCURATE, IT IS PROVIDED FOR YOUR GUIDANCE ONLY. BECAUSE MANY FACTORS MAY AFFECT PROCESSING OR APPLICATION/USE, WE RECOMMEND THAT YOU MAKE TESTS TO DETERMINE THE SUITABILITY OF A PRODUCT FOR YOUR PARTICULAR PURPOSE PRIOR TO USE. NO WARRANTIES OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE MADE REGARDING PRODUCTS DESCRIBED OR DESIGNS, DATA OR INFORMATION SET FORTH, OR THAT THE PRODUCTS, DESIGNS, DATA OR INFORMATION MAY BE USED WITHOUT INFRINGING THE INTELLECTUAL PROPERTY RIGHTS OF OTHERS. IN NO CASE SHALL THE DESCRIPTIONS, INFORMATION, DATA OR DESIGNS PROVIDED BE CONSIDERED A PART OF OUR TERMS AND CONDITIONS OF SALE. FURTHER, YOU EXPRESSLY UNDERSTAND AND AGREE THAT THE DESCRIPTIONS, DESIGNS, DATA, AND INFORMATION FURNISHED

PLATEAU® DG HERBICIDE
NVA 579652 Page : 6

SECTION 11 - TRANSPORTATION INFORMATION (cont)

BY BASF HEREUNDER ARE GIVEN GRATIS AND BASF ASSUMES NO OBLIGATION OR LIABILITY FOR THE DESCRIPTION, DESIGNS, DATA AND INFORMATION GIVEN OR RESULTS OBTAINED, ALL SUCH BEING GIVEN AND ACCEPTED AT YOUR RISK".

END OF DATA SHEET

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0 Reactivity Rating--Minimal

Reason for Revisions:
Change of Company Name & Address

Key Legend Information:
ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
TLV - Threshold Limit Value
PEL - Permissable Exposure Limit
TWA - Time Weighted Average
STEL - Short Term Exposure Limit
NTP - National Toxicology Program
IARC - International Agency for Research on Cancer
ND - Not determined

Disclaimer:
The information herein is given in good faith but no warranty, expressed or implied, is made.